OSI/FTAM Responder Manual

Abstract

This manual describes the operation of the Compaq Open Systems Interconnection/File Transfer, Access and Management (OSI/FTAM) responder and its virtual filestore (VFS). It is for programmers and users who are working with or writing remote FTAM applications that use the services of the Compaq responder. It is also useful to those with access to the Compaq system who are diagnosing and solving problems involving the Compaq FTAM responder.

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What's New in This Manual

Manual Information

Abstract

This manual describes the operation of the Compaq Open Systems Interconnection/File Transfer, Access and Management (OSI/FTAM) responder and its virtual filestore (VFS). It is for programmers and users who are working with or writing remote FTAM applications that use the services of the Compaq responder. It is also useful to those with access to the Compaq system who are diagnosing and solving problems involving the Compaq FTAM responder.

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New and Changed Information

This manual has been updated to support the G-series releases.

About This Manual

The *OSI/FTAM Responder Manual* provides instructions and reference information needed to write application programs, or to use interactive applications, that use the services of the Compaq OSI/File Transfer, Access and Management (FTAM) responder process. This manual has the following objectives:

- Introduce the Compaq FTAM responder and how it fits into the Compaq FTAM architecture
- Describe conformance and interoperability issues for the Compaq FTAM responder
- Provide information about the Compaq FTAM responder needed by the programmer writing FTAM applications (or the user using interactive FTAM applications) on a remote system, which may or may not be a Compaq system
- Provide information about the Compaq FTAM responder and its virtual filestore (VFS) needed for problem solving on the Compaq system

The descriptions that follow provide you with an overview of the content of each section and appendix in this manual.

- Section 1, "Introduction to Compaq OSI/FTAM," provides a general introduction to the Compaq FTAM software from the point of view of programmers writing remote FTAM applications that use the services of the Compaq FTAM responder.
- Section 2, "Conformance and Interoperability," presents information about standards conformance and interoperability of the Compaq FTAM responder.
- Section 3, "Compaq FTAM Responder Operation," describes the architecture of the Compaq FTAM responder and the way messages flow to and from the responder.
- Section 4, "Compaq FTAM Responder Support of ISO FTAM Functions," describes the ISO FTAM functions supported by the Compaq FTAM responder.
- Section 5, "Suggestions for Development of Remote Applications," provides suggestions for how to write your remote FTAM applications in order to take best advantage of the features of the Compaq FTAM responder.
- Section 6, "Responder Management," discusses considerations that are related to the configuration and management of the responder process and its VFS on the Compaq system, but that you might need to know when writing or using FTAM applications on the remote system.
- Appendix A, "Compaq FTAM Responder Diagnostic Messages," provides cause, effect, and recovery information for all diagnostic messages that originate in the Compaq FTAM responder or VFS.

Supported Standards

This manual and the other Compaq FTAM manuals are written on the assumption that you are familiar with the ISO standards and the National Institute of Standards and Technology (NIST) FTAM Phase 2 agreements to which Compaq FTAM and the underlying Compaq OSI products conform. These standards include the following:

Standard Number	Standard Name
ISO 8326	Basic Connection Oriented Session Service Definition
ISO 8327	Basic Connection Oriented Session Protocol Specification
ISO 8571-1	File Transfer, Access and Management—Part 1: General Introduction
ISO 8571-2	File Transfer, Access and Management—Part 2: Virtual Filestore Definition
ISO 8571-3	File Transfer, Access and Management—Part 3: File Service Definition
ISO 8571-4	File Transfer, Access and Management—Part 4: File Protocol Specification
ISO 8571-5	File Transfer, Access and Management—Part 5: Protocol Implementation Conformance Statement
ISO 8649	Service Definition for the Association Control Service Element
ISO 8650	Protocol Specification for the Association Control Service Element
ISO 8822	Connection Oriented Presentation Service Definition
ISO 8823	Connection Oriented Presentation Protocol Specification
ISO 8824	Specification of Abstract Syntax Notation One (ASN.1)
ISO 8825	Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)
ISO/IEC ISP 10607	Information Technology—International Standardized Profiles AFTnn—File Transfer, Access and Management, Parts 1-6
NIST 500-162	Stable Implementation Agreements for Open Systems Interconnection Protocols (Special Publication), Part 9—FTAM Phase 2

Related Manuals

This manual is one in a set of Compaq FTAM manuals.

- *OSI/FTAM Programming Guide*. This manual explains important programming concepts pertaining to the Compaq FTAM application programmatic interface and describes sequences of procedure calls to use to perform common FTAM programming operations. This manual also provides an overview of FTAM concepts for those who have not recently read the ISO 8571 specification.
- *OSI/FTAM Programming Reference Manual*. This is the companion manual to the Compaq OSI/FTAM Programming Guide and provides reference information on the programmatic interface provided by Compaq FTAM for application programs that run on a Compaq host using the FTAM initiator. It discusses product conformance to standards and interoperability, provides information on the FTAM initiator, and provides reference material for all procedure calls in the FTAM API (application programmatic interface), including descriptions of diagnostic and error messages.
- *OSI/FTAM Responder Manual*. This manual provides information for programmers writing applications on remote systems using the services of the Compaq FTAM responder. This manual discusses the Compaq FTAM responder's conformance to standards and interoperability, describes the operation of the responder, and provides reference information on diagnostic messages.
- *OSI/FTAM Configuration and Management Manual*. This manual provides task-oriented information necessary for the installation and management of the Compaq FTAM responder and virtual filestore (VFS) and the associated APLMGR process. This manual also includes information on monitoring and adjusting your subsystem to optimize performance and on diagnosing and fixing problems.
- *SCF Reference Manual for FTAM and APLMGR.* This manual describes the interactive interface that allows operators to manage and monitor the configuration and operation of FTAM responder and APLMGR processes, and to monitor FTAM subdevices, using SCF commands. It also describes the formats of trace records generated by responder and APLMGR processes.
- *Operator Messages Manual* . This manual describes Compaq operator messages in general and describes the operator messages that can be generated by various Compaq subsystems, including their causes, effects, and recovery actions. The "OSI/APLMGR Messages" and "OSI/FTAM Messages" sections describe the operator messages generated by Compaq FTAM.

If you are writing applications using a remote initiator that interoperates with the Compaq FTAM responder, your main source of information is the documentation for the FTAM initiator you are using. If your initiator is running on a system other than a Compaq system, you need whatever documentation is provided for the remote implementation.

If your FTAM initiator is on a Compaq system, you need the following manuals in the Compaq FTAM manual set: the *OSI/FTAM Programming Guide* and the *OSI/FTAM Programming Reference Manual*.

If you are diagnosing and solving FTAM problems using tools on the Compaq system where your responder resides, you also need to refer to the following manuals: the *OSI/FTAM Configuration and Management Manual* and the *SCF Reference Manual for FTAM and APLMGR*.

If you need to understand the meaning of event messages and additional information on displaying trace records for problem diagnosis, you need to refer to the following manuals:

- *PTrace Reference Manual* provides general information on how to select and interpret information in trace files created using the SCF TRACE command. This information serves as background for the trace-record information in the *SCF Reference Manual for FTAM and APLMGR*.
- *Operator Messages Manual*.

If you need to understand how files are stored in the Compaq responder's VFS or if you are diagnosing problems in the VFS, the following manuals are also likely to be of interest:

- *Enscribe Programmer's Guide* describes the four types of Enscribe disk files on the Compaq system (unstructured, key-sequenced, entry-sequenced, and relative).
- *NonStop SQL Installation and Management Manual* explains how to install NonStop SQL, the Compaq relational database management system, and how to plan, create, and manage NonStop SQL databases. This manual is useful to you if your applications access SQL tables as FTAM-2 files.
- *NonStop SQL Messages Manual* describes messages produced by the NonStop SQL relational database management system and file-system messages that pertain only to NonStop SQL files. This manual is useful to you if your applications access SQL tables as FTAM-2 files.

Your Comments Invited

After using this manual, please take a moment to send us your comments. You can do this by returning a Reader Comment Card or by sending an Internet mail message.

A Reader Comment Card is located at the back of printed manuals and as a separate file on the User Documentation disc. You can either fax or mail the card to us. The fax number and mailing address are provided on the card.

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Many of the improvements you see in manuals are a result of suggestions from our customers. Please take this opportunity to help us improve future manuals.

Notation Conventions

General Syntax Notation

The following list summarizes the notation conventions for syntax presentation in this manual.

UPPERCASE LETTERS. Uppercase letters indicate keywords and reserved words; enter these items exactly as shown. Items not enclosed in brackets are required. For example:

```
MAXATTACH
```

lowercase italic letters. Lowercase italic letters indicate variable items that you supply. Items not enclosed in brackets are required. For example:

```
file-name
```

[ ] Brackets. Brackets enclose optional syntax items. For example:

```
TERM [\system-name.]$terminal-name
```

```
INT[ERRUPTS]
```

A group of items enclosed in brackets is a list from which you can choose one item or none. The items in the list may be arranged either vertically, with aligned brackets on each side of the list, or horizontally, enclosed in a pair of brackets and separated by vertical lines. For example:

```
FC [ num ]
   [ -num]
   [ text]
```

```
K [ X | D ] address-1
```

{ } Braces. A group of items enclosed in braces is a list from which you are required to choose one item. The items in the list may be arranged either vertically, with aligned braces on each side of the list, or horizontally, enclosed in a pair of braces and separated by vertical lines. For example:

```
LISTOPENS PROCESS { $appl-mgr-name }
                  { $process-name  }
```

```
ALLOWSU { ON | OFF }
```

| Vertical Line. A vertical line separates alternatives in a horizontal list that is enclosed in brackets or braces. For example:

```
INSPECT { OFF | ON | SAVEABEND }
```

… Ellipsis. An ellipsis immediately following a pair of brackets or braces indicates that you can repeat the enclosed sequence of syntax items any number of times. For example:

```
M address-1 [ , new-value ]...
```

```
[ - ] {0|1|2|3|4|5|6|7|8|9}...
```

An ellipsis immediately following a single syntax item indicates that you can repeat that syntax item any number of times. For example:

```
"s-char..."
```

Punctuation. Parentheses, commas, semicolons, and other symbols not previously described must be entered as shown. For example:

```
error := NEXTFILENAME ( file-name ) ;

LISTOPENS SU $process-name.#su-name
```

Quotation marks around a symbol such as a bracket or brace indicate the symbol is a required character that you must enter as shown. For example:

```
"[" repetition-constant-list "]"
```

Item Spacing. Spaces shown between items are required unless one of the items is a punctuation symbol such as a parenthesis or a comma. For example:

```
CALL STEPMOM ( process-id ) ;
```

If there is no space between two items, spaces are not permitted. In the following example, there are no spaces permitted between the period and any other items:

```
$process-name.#su-name
```

Line Spacing. If the syntax of a command is too long to fit on a single line, each continuation line is indented three spaces and is separated from the preceding line by a blank line. This spacing distinguishes items in a continuation line from items in a vertical list of selections. For example:

```
ALTER [ / OUT file-spec / ] CONTROLLER

   [ , attribute-spec ]...
```

!i and !o. In procedure calls, the !i notation follows an input parameter (one that passes data to the called procedure); the !o notation follows an output parameter (one that returns data to the calling program). For example:

```
CALL CHECKRESIZESEGMENT (  segment-id                    !i
                         , error        ) ;              !o
```

!i,o. In procedure calls, the !i,o notation follows an input/output parameter (one that both passes data to the called procedure and returns data to the calling program). For example:

```
error := COMPRESSEDIT ( filenum ) ;                      !i,o
```

!i:i. In procedure calls, the !i:i notation follows an input string parameter that has a corresponding parameter specifying the length of the string in bytes. For example:

```
error := FILENAME_COMPARE_ (  filename1:length           !i:i
                            , filename2:length ) ;       !i:i
```

!o:i. In procedure calls, the !o:i notation follows an output buffer parameter that has a corresponding input parameter specifying the maximum length of the output buffer in bytes. For example:

```
error := FILE_GETINFO_ (  filenum                          !i
                        , [ filename:maxlen ] ) ;          !o:i
```

Notation for Messages

The following list summarizes the notation conventions for the presentation of displayed messages in this manual.

Bold Text. Bold text in an example indicates user input entered at the terminal. For example:

```
ENTER RUN CODE
?123
CODE RECEIVED:      123.00
```

The user must press the Return key after typing the input.

Nonitalic text. Nonitalic letters, numbers, and punctuation indicate text that is displayed or returned exactly as shown. For example:

```
Backup Up.
```

lowercase italic letters. Lowercase italic letters indicate variable items whose values are displayed or returned. For example:

```
p-register
process-name
```

[ ] Brackets. Brackets enclose items that are sometimes, but not always, displayed. For example:

```
Event number = number [ Subject = first-subject-value ]
```

A group of items enclosed in brackets is a list of all possible items that can be displayed, of which one or none might actually be displayed. The items in the list might be arranged either vertically, with aligned brackets on each side of the list, or horizontally, enclosed in a pair of brackets and separated by vertical lines. For example:

```
proc-name trapped [ in SQL | in SQL file system ]
```

{ } Braces. A group of items enclosed in braces is a list of all possible items that can be displayed, of which one is actually displayed. The items in the list might be arranged

either vertically, with aligned braces on each side of the list, or horizontally, enclosed in a pair of braces and separated by vertical lines. For example:

```
obj-type obj-name state changed to state, caused by
{ Object | Operator | Service }
```

```
process-name State changed from old-objstate to objstate
{ Operator Request. }
{ Unknown.          }
```

| Vertical Line. A vertical line separates alternatives in a horizontal list that is enclosed in brackets or braces. For example:

```
Transfer status: { OK | Failed }
```

% Percent Sign. A percent sign precedes a number that is not in decimal notation. The %þnotation precedes an octal number. The %Bþnotation precedes a binary number. The %Hþnotation precedes a hexadecimal number. For example:

```
%005400
```

```
P=%p-register E=%e-register
```

Notation for Management Programming Interfaces

The following list summarizes the notation conventions used in the boxed descriptions of programmatic commands, event messages, and error lists in this manual.

UPPERCASE LETTERS. Uppercase letters indicate names from definition files; enter these names exactly as shown. For example:

```
ZCOM-TKN-SUBJ-SERV
```

lowercase letters. Words in lowercase letters are words that are part of the notation, including Data Definition Language (DDL) keywords. For example:

```
token-type
```

!r. The !r notation following a token or field name indicates that the token or field is required. For example:

```
ZCOM-TKN-OBJNAME      token-type ZSPI-TYP-STRING.          !r
```

!o. The !o notation following a token or field name indicates that the token or field is optional. For example:

```
ZSPI-TKN-MANAGER      token-type ZSPI-TYP-FNAME32.         !o
```

1

Introduction to the Compaq FTAM Responder

This manual describes the Compaq Open Systems Interconnection/File Transfer, Access and Management (OSI/FTAM) **responder** and its virtual filestore (**VFS**). Compaq OSI/FTAM is the Compaq implementation of the FTAM standard ISO 8571, developed by the International Organization for Standardization (**ISO**).

File Transfer, Access and Management (**FTAM**) is a set of **Application Layer services** and an Application Layer **protocol** to support file handling on Open Systems Interconnection (**OSI**) networks. Using this standard FTAM protocol across an OSI network, different computer systems can transmit and receive file contents and file-management-related messages.

The information in this manual is useful to you if you are doing either of the following:

- Developing FTAM **applications**, or using interactive FTAM applications, that run on remote systems and use the services of the Compaq FTAM responder
- Solving problems involving a Compaq FTAM responder or its virtual filestore (VFS)

While this manual is designed to be as complete as possible with regard to the Compaq FTAM implementation of the responder, it is not intended to duplicate or replace the ISO standards and National Institute of Science and Technology (**NIST**) FTAM Phase 2 agreements. The preface to this manual, called "About This Manual," lists the relevant ISO and NIST documents that you may want to review.

In this manual, **ISO FTAM** refers to the FTAM specification as defined in ISO 8571, and **Compaq FTAM** refers to the Compaq OSI/FTAM product.

Functional Overview

ISO FTAM provides the following file-handling functions across the network:

- Creating files
- Deleting files
- Erasing part or all of the contents of files
- Reading from files
- Writing to files
- Reading file **attributes**
- Changing file attributes

FTAM users communicate with the FTAM **service provider** by way of **primitives**, the smallest units of interaction between the FTAM user and the FTAM service provider. An operation like any of those mentioned above requires the exchange of multiple primitives, which the FTAM software encodes as protocol data units (**PDUs**).

FTAM file handling is defined in terms of **initiator** and responder functions. The initiator provides application programs with access to the FTAM protocol so that you can request services to be performed by a responder across the network. The remote responder acts as a file server and performs the requested services.

Compaq FTAM Services

Compaq FTAM provides most of the FTAM services specified in ISO 8571.

The Compaq FTAM implementation separates the initiator and responder functions into two **processes**. The Compaq FTAM initiator process implements the initiator function, while the Compaq FTAM responder process implements the responder function.

Note. The initiator and responder functions of remote FTAM implementations are not necessarily performed by separate processes. In this manual, the term “remote initiator” refers to the entity in the remote implementation that performs the initiator function.

The initiator and responder processes provide the FTAM functions required for your applications. These processes manage the FTAM communications among your application and other FTAM applications on the local or remote computer systems on an OSI network.

Compaq FTAM can handle the following types of files, where the corresponding FTAM **document types** are listed parenthetically:

- Unstructured text files (**FTAM-1**)
- Structured text files (**FTAM-2**)
- Binary files (**FTAM-3**)
- Directory files (**NBS-9**)

FTAM Applications

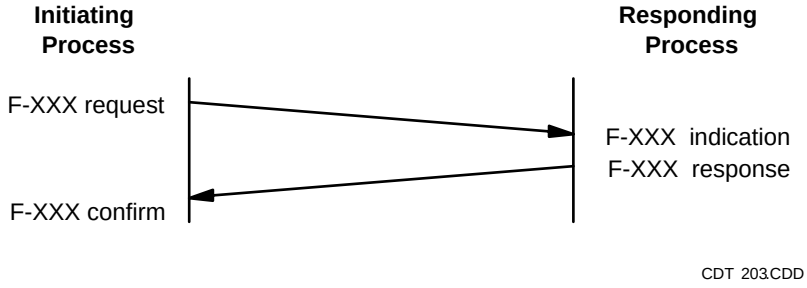
This manual focuses on the FTAM services available to remote ISO FTAM applications through the Compaq FTAM responder. There is no **programmatic interface** to the Compaq responder; you request the services of the responder by means of the FTAM interface on your remote system, which may or may not be a Compaq system.

ISO FTAM protocol defines a common model of the file system (the virtual filestore, described later in the manual), which allows all computer systems on an **open network** to share the same file-handling conventions. Because the Compaq FTAM responder manages its own local file system, you do not need to learn how to program file handling for the Compaq NonStop Kernel (the operating system) or the Guardian environment (the application program interface and the Compaq NonStop tools) when using the Compaq responder. In writing FTAM applications that use the services of the

responder, you use the standard FTAM file-handling conventions to perform remote file-handling tasks, by means of the FTAM interface on your remote system.

Each FTAM service, or file operation, requires that multiple FTAM protocol operations be performed, in sequence, to complete the service. For example, to open a file, an FTAM application must first send an initialize request, and then a file-select request and a file-open request, to the responding system in the communication. The responding FTAM node receives the requests as indications and sends responses back to the requesting node. The requesting node receives these responses as confirms. Thus, four primitives—**request**, **indication**, **response**, and **confirm**—are used to complete most services, as shown in Figure 1-1. Section 4 identifies the FTAM services supported in the Compaq FTAM implementation.

Figure 1-1. An FTAM Service Using Four Primitives



The ISO standard provides flexibility in the level of FTAM function that must be implemented in an ISO-conformant system. This flexibility implies that, as you write and test your application, you need to consider the specifications for the other FTAM implementations with which your application will interoperate. Refer to Section 2 for information about the factors to consider in assessing the **interoperability** of the Compaq FTAM product with other FTAM implementations.

If your remote FTAM application also runs on a Compaq system, you use the Compaq FTAM **application program interface** (API), a set of procedures that interact with the Compaq FTAM initiator process, to request FTAM services. The initiator, in turn, sends requests for file-handling services to remote responders. The FTAM API is described in detail in the *OSI/FTAM Programming Reference Manual* and the *OSI/FTAM Programming Guide*.

Management Interfaces

For those people with access to the Compaq system who are responsible for configuring and managing FTAM responder processes and for solving FTAM problems, Compaq FTAM supports the Distributed Systems Management (**DSM**) **management interfaces**, which include the following:

- Subsystem Control Facility **(SCF)**
- **PTrace** utility
- **Operator message** facility of the Event Management Service (**EMS**)

The use of these management utilities with Compaq FTAM is described in the *OSI/FTAM Configuration and Management Manual*.

In addition, system managers and problem solvers on the Compaq system use the File Utility Program (**FUP**) to perform many functions on Compaq disk files, including copying and resecuring files. This utility is described in the *File Utility Program (FUP) Reference Manual*.

Architectural Overview

FTAM services facilitate communication between different computer systems in an OSI network. The communication link (at the FTAM level) created between two systems is called an **association**. Each system is further defined in terms of its function in the association. The system that creates and controls the association is called the initiating system. The system that responds to the initiating system is called the responding system. In Compaq FTAM, the initiating and responding functions are performed by separate processes.

The Compaq FTAM responder process services FTAM requests initiated from remote systems on the network, such as a request to read a file. The responder acts as an FTAM file server, mapping FTAM requests into file operations and providing a translation between Guardian file structures and FTAM file structures.

The Responder and Underlying Subsystems

To communicate over OSI networks, Compaq FTAM uses the services of the Compaq **OSI/AS** and **OSI/TS subsystems**, and either the Compaq LAN access method (**TLAM**) (or PAM for G06 and above releases), or the X.25 access method (**X25AM**), or TCP/IP. In turn, X25AM and TLAM depend on hardware controllers to provide the 802.3 communications protocol (for TLAM) and the X.25 communications protocol (for X25AM).

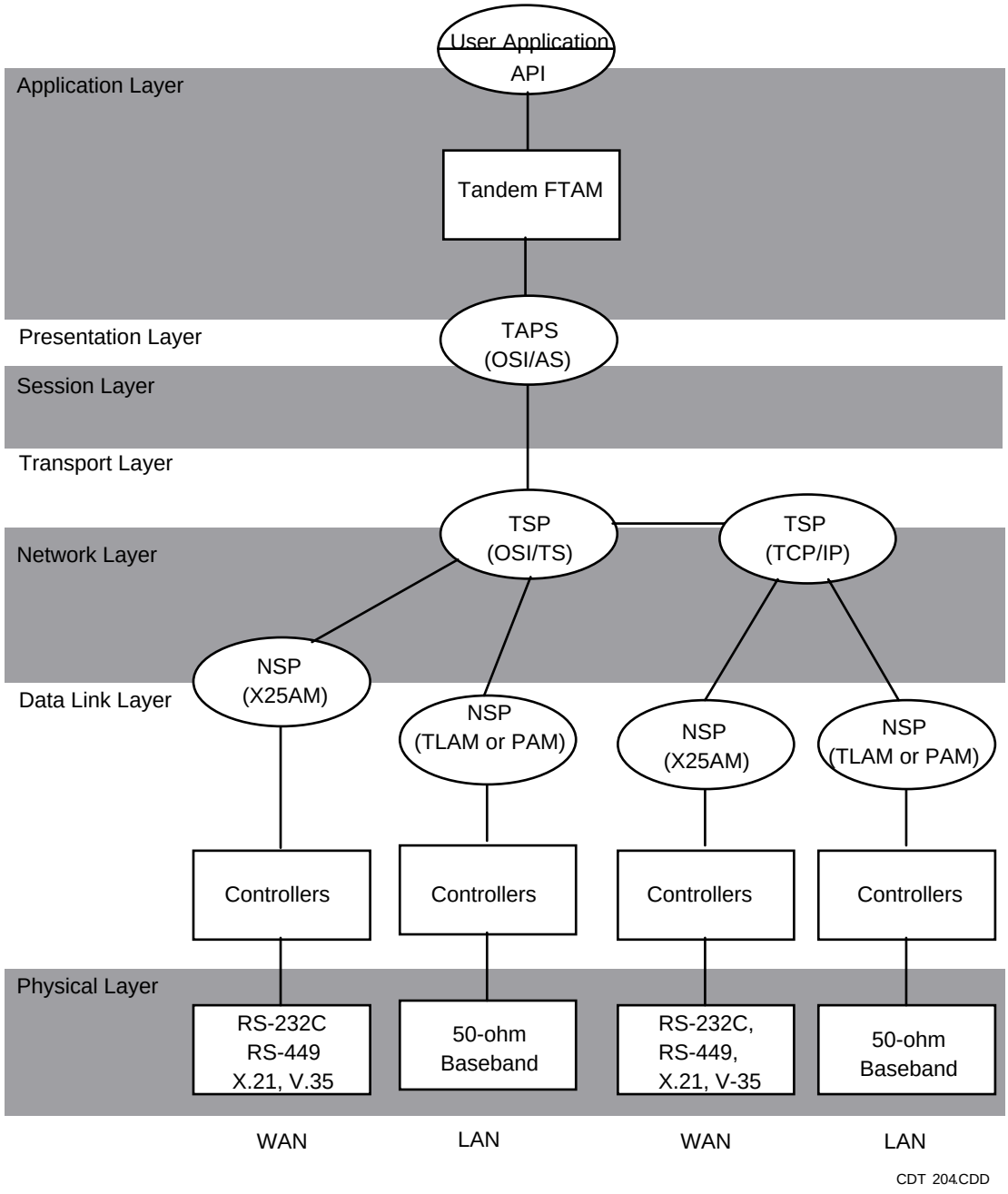
Figure 1-2 provides an overview of the Compaq FTAM responder and these underlying Compaq products. The figure illustrates how the Compaq FTAM responder and the underlying Compaq **OSI subsystems** support the **layers** of the **OSI Reference Model** for both LANs and WANs:

- The Compaq FTAM responder provides FTAM responder functions at the Application Layer.

- Compaq application, presentation, and session service provider (**TAPS**) **processes** perform the services of the Association Control Service Element (**ACSE**) in the Application Layer, plus the services of the **Presentation Layer** and the **Session Layer**. TAPS processes are provided by the OSI/AS subsystem.
- Transport service provider (**TSP**) **processes** perform the services of the **Transport Layer**. These processes are provided by the OSI/TS subsystem.
- Network service provider (**NSP**) **processes** perform the services of the **Network Layer** and/or the **Data Link Layer**. These processes are provided by the X25AM and TLAM (or PAM for G06 and above releases) and TCP/IP subsystems.

The figure also shows the hardware used to implement Data Link Layer and **Physical Layer** OSI communications through TLAM (or PAM) or X25AM.

Figure 1-2. Compaq FTAM Responder Architectural Overview



PDUs from a remote FTAM initiator are received by the Compaq system at the Physical Layer and are transmitted up through the appropriate communications controller (or adapter), NSP process, TSP process, and TAPS process to the FTAM responder process.

The Responder and the File System

Figure 1-2 also shows the file system used by the Compaq responder to access files.

When a remote FTAM initiator requests access to files, the Compaq FTAM responder provides that service via its virtual filestore (VFS) component, which acts as an interface to the file system. The set of files accessible via the VFS includes all files on the **Expand network** to which the Compaq FTAM responder process' system belongs.

The responder's VFS maps the FTAM requests into file requests and translates between FTAM and Guardian file structures and attributes. For more information on the VFS and how it maps particular file structures and attributes, refer to Sections 3 and 4.

2 Conformance and Interoperatility

This section presents information about the conformance to standards and the interoperability of the Compaq FTAM responder.

Conformance is the satisfaction of the requirements of the applicable standards, consistent with the capabilities stated in the protocol implementation conformance statement (PICS) for the implementation. Interoperability is the ability of an implementation of a standard to work with other implementations of the same standard to deliver services.

A list of the supported standards and agreements that apply to Compaq FTAM is provided in "About This Manual" at the beginning of this manual.

Conformance

To be ISO FTAM-conformant, an FTAM implementation must comply with the International Organization for Standardization (ISO) FTAM standard for communication between different FTAM implementations. Conformance to the ISO FTAM standard is tested in the areas of the support of services, **functional units**, **service classes**, and **file attributes**.

Conformance testing increases the probability that an implementation is able to interwork with other implementations. Two or more implementations are more likely to work together if they conform to the same set of standards.

The Compaq OSI/FTAM product has been tested to conform with ISO 8571, NIST Special Publication 500-162 (Stable Implementation Agreements for Open Systems Interconnection Protocols) Part 9—FTAM Phase 2, and US GOSIP version 1.0.

Interoperability

The interoperability, or interworking, of two FTAM implementations is the ability of these implementations to communicate using FTAM primitives in a useful and meaningful way. While conformance to ISO FTAM is necessary, it does not by itself guarantee that two implementations will interwork. Even if the two implementations conform to the same OSI protocol standard, they may be incapable of interworking with each other for reasons outside the scope of that standard (see ISO IS 9646-1, section 5.7.2). In addition, the FTAM standard is very complex. Two implementations may contain disjoint subsets of the standard that do not allow for interoperability but are fully conformant to the ISO specification. For example, two systems cannot interoperate if each supports only an initiator, or if a document type supported by an initiator is not included among the document types supported by the responder.

The Compaq FTAM product has been tested to conform with the standards and **profiles** mentioned in the above subsection, "Conformance." It has also been tested to interoperate with a number of other vendors according to the NISTIR 4435 document, "FTAM Interoperability Tests," which most vendors use as a basis for writing FTAM interoperability tests.

When evaluating interoperability between Compaq FTAM and another FTAM implementation, consider the following aspects in which FTAM implementations can vary. Section 4 of this manual provides you with additional details about the Compaq FTAM implementation that you need to determine whether another implementation can interoperate with the Compaq FTAM product.

Basic Characteristics of FTAM Implementations

To determine whether another FTAM implementation can interoperate with Compaq FTAM, you must first consider the following basic characteristics of the two implementations.

Roles of Initiator and Responder

Initiator and responder roles must be compatible to interoperate successfully. For two implementations to interoperate, there must be an initiator and a responder that can send and receive data between the two. For more information, see Section 4.

Roles of Sender and Receiver

The **sender** is the entity that sends data. The **receiver** is the entity receiving data. In Compaq FTAM, both the initiator and the responder have sender and receiver capabilities. For example, an initiator sending a read request is the receiver, and an initiator sending a write request is the sender.

Service Classes Supported

The service classes supported are defined in terms of combinations of functional units. At least one common service class must be supported for two implementations to interoperate. Compaq FTAM supports four service classes: **file transfer**, **file management**, **file transfer and management**, and **file access**.

Underlying Services

Compaq FTAM uses Compaq OSI/AS, which is an implementation of version 1 of the Association Control Service Element (ACSE), as stated in ISO IS 8649 and 8650; version 1 of the **Presentation Layer**, as stated in ISO IS 8822 and 8823; and version 2 of the **Session Layer**, as stated in ISO IS 8326 and 8327. To interoperate with Compaq FTAM, other FTAM implementations must support compatible versions of ACSE, Presentation, and Session, as well as the services underlying the Session Layer.

Functional Units

Both implementations must support the functional units required for any services the pair will perform together. Compaq FTAM supports seven functional units: **kernel**, **read**, **write**, **file access**, **limited file management**, **enhanced file management**, and **grouping**.

Attributes

Aspects of attributes that can affect interoperability include the optional groups of attributes, the level of support for each individual attribute (see Table 4-4) and its optional components, and the range of values supported for each attribute. The Compaq FTAM implementation supports three **attribute groups**: **kernel**, **storage**, and **security**. For more information on attributes and attribute support for the Compaq FTAM responder, see Section 4.

FTAM Parameters

Aspects of FTAM parameters that can affect interoperability include the supported **optional parameters** and the range of values for all parameters. If they are to interoperate, both implementations must support all parameters and ranges required by the services to be performed. For more information on the optional parameters and parameter value ranges supported by the Compaq FTAM responder, see Section 4.

Limitations on Value of Future-Filesize Attribute

Because of file-size limitations imposed by the Guardian file system, the Compaq FTAM responder cannot support all possible values of the **future-filesize attribute** sent in create and change-attribute requests. The Compaq responder creates files with a maximum future-filesize value of 1 GB. If a value greater than 1 GB is requested, the responder returns an **informative diagnostic message** and creates the file with a future-filesize value of 1 GB.

The smallest file the Compaq responder can create has a future-filesize value of 64 KB. If a smaller future-filesize value is requested, the responder creates the file with a future-filesize value of 64 KB. (Note, however, that the entire 64K is not necessarily allocated; only as many extents as needed are allocated.)

In addition, the maximum size of files is limited by the physical storage capacity of the Compaq disk device being used.

Document Types and Related Parameters

Both implementations must support one or more common document types to interoperate. Compaq FTAM supports the following document types: FTAM-1, FTAM-2, FTAM-3, and NBS-9. In addition, both implementations must be aware of how the parameters associated with document type (the **maximum-string-length**, **string-significance**, and **universal-class** parameters) are used in the FTAM software with which they wish to interoperate.

The NBS-9 document type allows reading of directory information using an attribute bit string.

For more information on Compaq FTAM document types and related parameters, see Section 4.

Maximum-String-Length Parameter

Compaq FTAM supports unbounded strings. The limitations of the maximum-string-length parameter are described in detail in Section 4.

String-Significance Parameter

The Compaq FTAM responder supports all three values (fixed, variable, and not-significant) for the string-significance parameter in FTAM-1 documents. For the FTAM-3 document type, it supports the values not-significant, fixed, and variable.

Universal-Class Parameter

The default universal-class parameter value used by the Compaq FTAM responder for FTAM-1 and FTAM-2 files is **GraphicString**, as specified in ISO 8571.

Simplification and Relaxation

Simplification is the act of reading a file of a specific FTAM document type as a less structured, or simpler, FTAM document type. Compaq FTAM supports the simplification of FTAM-2 **Enscribe** relative files to FTAM-1 files, but does not support simplification of Structured Query Language (**SQL**) tables.

Relaxation, or the process of deriving one document from another by making the parameters describing it less restrictive, is not supported at all by Compaq FTAM.

Mapping of Contents-Type Parameters

The Compaq FTAM virtual filestore (VFS) supports the Compaq FTAM responder by providing an interface to the Guardian file system. It maps FTAM file structures and attributes to Guardian file structures and attributes, and vice versa. Section 4 describes the mappings of FTAM document types to Guardian file types.

Note that the Compaq responder does not keep a permanent record of the contents-type parameter values used on creation of a file in the VFS. These values are directly available only during the life of the FTAM association in which the file was created. When a remote initiator makes a create request followed by an open request and the open request specifies a contents type of unknown, the responder uses the contents-type parameter values specified in the create request. However, this information is lost when the association is terminated. On subsequent accesses to the file via a select request followed by an open request with a contents type of unknown, the responder uses its default values based on the file structure, as described in Section 4.

Data-Transfer Considerations

This subsection briefly describes the aspects of Compaq FTAM data handling that might affect interoperability between the Compaq FTAM responder and another FTAM implementation. For complete information, see Section 4.

Limits on Small String-Length Values With Large PDUs

When the Compaq FTAM responder receives data from a remote initiator, it decodes the data and stores it, as a sequence of strings, in an internal buffer with a maximum size of 25 KB. According to the NIST FTAM Phase 2 agreements, P-DATA carrying encoded FTAM PDUs or data elements cannot exceed 16 KB; however, string-header information in the buffer can cause the data in the buffer to be much larger than the maximum size of the encoded data. Because each string in the buffer includes a fixed number of bytes of header information, packing small strings into a large PDU can cause the 25 KB buffer size to be exceeded.

During data decoding, the responder checks the length of the data. If the decoded data cannot be accommodated in the 25 KB buffer, the responder generates a **provider abort**.

To avoid exceeding the buffer-size limit for writes to the Compaq responder, you can either send a smaller number of strings per PDU or send larger strings, as described in Section 4.

Handling of Escape Sequences

When writing data to the Guardian file system from a remote initiator, the responder first removes any escape sequences contained in each string it receives before enforcing the maximum-string-length limitation. When sending data to the remote initiator, it does not check for escape sequences, but simply counts all bytes and packages them into strings.

Use of Format Effectors

Format effectors are characters such as carriage returns and line feeds, which control the formatting of information on character-imaging devices. To interoperate successfully, application programmers must understand what an implementation expects as an end-of-line symbol and how it interprets format effectors. For example, some implementations use the FTAM-1 document type to transfer binary data as opposed to text. Some implementations recognize carriage returns and line feeds as format effectors and discard them if binary data, not text, is being transferred. Others see the format effectors as data and transfer them as such.

In the Compaq FTAM responder's virtual filestore (VFS), FTAM-1 files are treated as documents and are implemented as Guardian EDIT files, which have a maximum record length of 239 characters. The responder interprets carriage return-line feed combinations (CR/LFs) as end-of-line indicators. If a file being written to the responder's VFS does not contain CR/LFs, the file is written in 239-character records.

Character Sets

The Compaq FTAM responder does no character-set verification. For FTAM-1 and FTAM-2 files, to ensure that the file being transferred contains the correct character-string type as specified in the universal-class parameter, your remote application should verify characters as it sends or receives the data.

For FTAM-3 files, keep in mind that the native character sets (ASCII, EBCDIC, and so on) might be incompatible on the sending and receiving systems. For example, Compaq systems use the 7-bit ASCII character set, whereas some other vendors' systems use 8-bit EBCDIC. If you decide to send or receive text characters as FTAM-3 binary data, some conversion of the native character set might be necessary.

Some files might contain multiple character sets. The file system provides no means of storing information on the location of character-set transitions within a file residing in it. Because the Compaq responder removes escape sequences when enforcing maximum-string-length limitations on data being written to the VFS, indications of transitions between character sets are lost.

Writing of FTAM-2 Files

FTAM-2 files that are SQL tables must be written using the flat all data units (FA) access context, since each incoming data element represents a single SQL field and node descriptors are needed to delineate rows. Attempting to write to an SQL table using the unstructured all data (UA) access context causes the responder to return a cancel request that includes a diagnostic message indicating a poorly specified FADU. The file is left in an unknown state.

FTAM-2 files that are not SQL tables may be written using either the FA or UA access context. When FTAM-2 files are written using the FA access context, the responder expects each text data element transferred to be preceded by a node-descriptor data element. If the node descriptor element is omitted, the responder returns a cancel request that includes a diagnostic message indicating an FTAM protocol **error**

Presentation Encoding of FTAM PDUs and Data

As described in ISO 8823, clause 8, there are several options for encoding FTAM PDUs as presentation data. Presentation data is encoded as a SEQUENCE OF PDV-list. Each PDV list contains one or more presentation data values (PDVs). PDV lists are encoded as single-ASN1-type, octet-aligned, or arbitrary. If only a single Abstract Syntax Notation-1 (**ASN.1**) data element (that is, a single PDV) is to be encoded, then a single PDV list encoded as single-ASN1-type may be used. However, if multiple ASN.1 data elements (that is, multiple PDVs) are to be encoded (as with grouped requests, concatenated PDUs, and most F-DATA requests), there are several options:

- Place the PDVs in a single PDV list encoded as octet-aligned.
- Place the PDVs in multiple PDV lists, each containing one ASN.1 data element (one PDV), encoded as single-ASN1-type.
- Place the PDVs in multiple PDV lists, some containing multiple data elements encoded as octet-aligned and others containing a single data element encoded as single-ASN1-type.

Any of these three options is valid if all data elements have the same **presentation context**. If different presentation contexts are needed (as would be the case, for example, with FTAM-2 data using the FA access context), a separate PDV list must be used for each different presentation context, and the third option applies.

When receiving PDUs, Compaq FTAM supports all three options listed above. When sending PDUs, Compaq FTAM follows these rules:

- If single FTAM PDUs are to be sent, they are placed in a single PDV list encoded as single-ASN1-type.
- If multiple FTAM PDUs are to be sent (grouped requests or responses), they are sent in a single PDV list encoded as single-ASN1-type.
- When F-DATA requests are sent by the Compaq responder, the method of encoding depends on the number of data elements to be encoded. If only a single data element is to be sent, it is placed in a single PDV list encoded as single-ASN1-type. If more than one data element is to be sent, the data elements are placed in a single PDV list, encoded as octet-aligned.

For FTAM-2 files, node-descriptor data elements are placed in their own PDV lists as single-ASN1-type. Consecutive file-contents data elements are placed in a single PDV list as either single-ASN1-type or octet-aligned, depending on whether one or more consecutive data elements exist.

3

Compaq FTAM Responder Operation

The Compaq responder receives an FTAM request from an initiating system, processes it, performs the appropriate action, and returns an FTAM response to the initiating system. It performs file-handling operations through its virtual filestore (VFS), which acts as an interface to the Guardian file system.

This section explains the major components of the Compaq responder process and describes the flow of communication between an initiating system and the Compaq responder.

Responder Structure

The Compaq responder process can be broken down into several components that perform services for FTAM applications.

Figure 3-1 outlines the components of the responder that process FTAM requests, perform the requested FTAM operations, and respond to the remote FTAM user. It focuses on the responder components specific to performing FTAM services and does not reflect the parts of the responder that format data or process management messages, for example.

Figure 3-1 shows the following responder components:

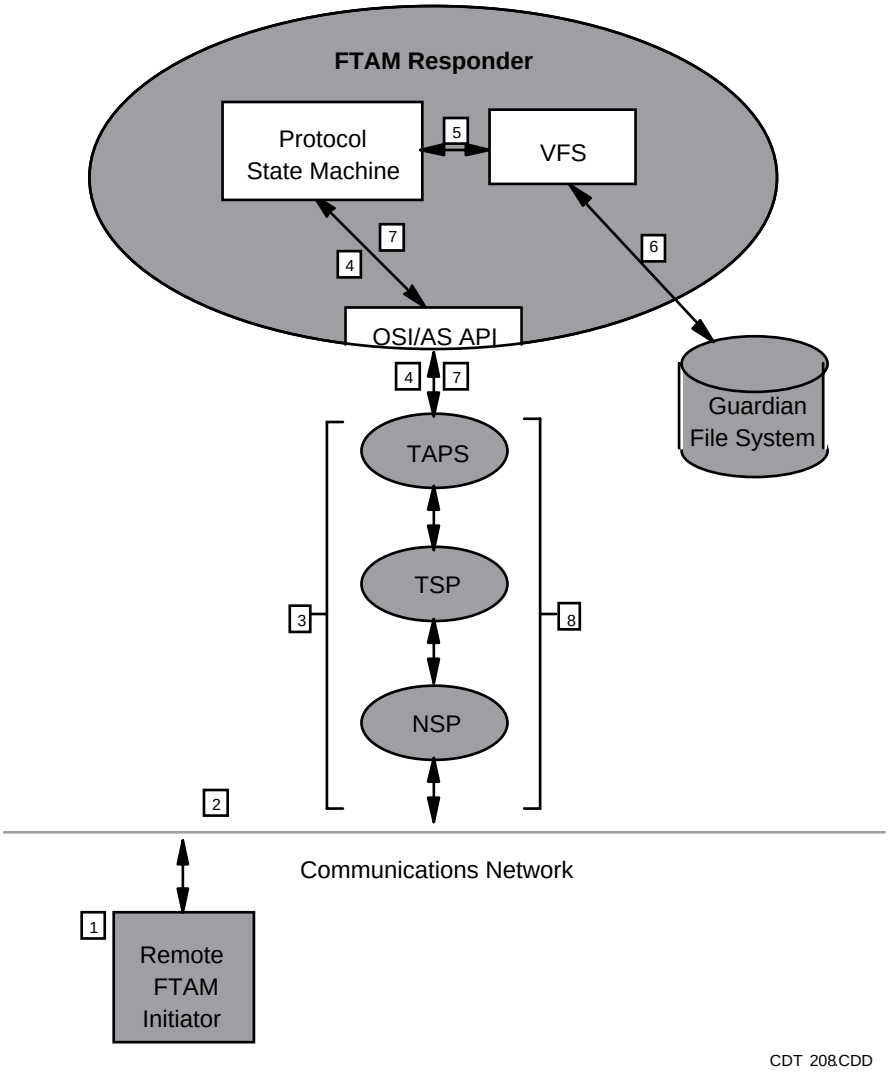
- The **protocol state machine** receives requests for new FTAM associations and for FTAM services, in the form of indications, from the TAPS process in the OSI/AS subsystem. It checks the FTAM requests for protocol errors, and if it finds none, takes the action necessary to perform the requested service. This action may require access to the file system through the responder VFS component.

  Once any operations involving the file system are complete, the protocol state machine updates the **state** information for the association and sends a response to the remote FTAM initiator via the underlying OSI network.

- The virtual filestore (VFS) acts as an interface to the file system. Files accessible via the file system can also be accessed via the VFS component of the Compaq responder. The VFS is responsible for translating file structures and attributes into FTAM file structures and attributes, and vice versa. This translation is described further in Section 4 under “File-Attribute Mappings.”

- The responder communicates with underlying Compaq OSI/AS processes through the OSI/AS API.

Figure 3-1. Compaq FTAM Responder Process



Responder Data Flow

Protocol and user data generally flows to and from the Compaq responder in the steps described below. Note that the responder sends primarily responses, although cancel and abort requests—and data indications during a data transfer—are also possible. For the purposes of this subsection, assume that the remote initiator sends an FTAM request and the responder returns a response to that request. This sequence of steps assumes that you have already established an association.

The numbers shown in Figure 3-1 correspond to the sequence of steps outlined below.

1. An FTAM application, typically on a remote system, issues an FTAM request to the FTAM initiator supporting it.

2. The FTAM initiator follows the OSI protocol established on the initiating system to send the outgoing FTAM protocol data unit (PDU) over the network to the Compaq responding system, where it is received as an indication.
3. Once on the Compaq responding system, the incoming FTAM indication is sent through the NSP, TSP, and TAPS processes, where it is formatted and processed as required by each OSI layer.
4. After processing the indication, the TAPS process sends the PDU through the OSI/AS API to the protocol state machine of the responder.
5. The protocol state machine decodes and checks the validity of the indication and, if the indication is valid, performs the requested action, communicating with the VFS where file-system access is required.
6. .The VFS accesses the file system via standard procedure calls and informs the protocol state machine when the requested file-system actions are completed.
7. Based on the outcome of the file-system actions, the protocol state machine encodes and sends a response PDU to the TAPS process for transmission to the FTAM initiator. This response contains any diagnostic messages resulting from its checking of FTAM protocol or from VFS communication with the file system.
8. .The TAPS process formats the PDU and forwards it to the TSP process. The TSP process, in turn, formats the PDU and sends it to the NSP process. The NSP process, depending on the network protocol that it supports, formats the PDU and forwards it via the appropriate controller (or adapter) over the network to the initiating system, where it is received as a confirm.

4

Compaq FTAM Responder Support of ISO FTAM Functions

This section provides detailed information on the Compaq FTAM responder's support of ISO FTAM functions. It includes the following information:

- FTAM functions supported by the Compaq responder
- Virtual filestore (VFS) mapping considerations for FTAM document types
- VFS mapping considerations for FTAM file and activity attributes
- Support for optional parameters in request and response PDUs
- VFS file-access and security considerations

Supported Functions

The functional scope of an FTAM association depends on which FTAM functions are supported both by the Compaq FTAM responder and the remote FTAM initiator with which it is interoperating. The following four tables identify the FTAM service classes, functional units, attribute groups, and attributes that the Compaq responder process supports.

For a listing and explanation of these FTAM functions as specified by ISO, refer to ISO 8571, parts 2 and 3.

Service Classes

Table 4-1 identifies the FTAM service classes that the Compaq responder process supports. The Compaq responder supports all ISO-defined service classes except the unconstrained class.

Table 4-1. Service Classes Supported by the Compaq FTAM Responder

Service Class	Compaq Support
File transfer	X
File access	X
File management	X
File transfer and management	X
Unconstrained	

Functional Units

Table 4-2 identifies the FTAM functional units that the Compaq responder process supports. The Compaq responder supports all ISO-defined functional units except the FADU locking, recovery, and restart-data-transfer functional units.

Table 4-2. Functional Units Supported by the Compaq FTAM Responder

Functional Unit	Compaq Support
Kernel	X
Read	X
Write	X
File access	X
Limited file management	X
Enhanced file management	X
Grouping	X
FADU locking	
Recovery	
Restart data transfer	

Attribute Groups

Table 4-3 identifies the FTAM attribute groups that the Compaq responder process supports. The Compaq responder supports all ISO-defined attribute groups except the private group.

Table 4-3. Attribute Groups Supported by the Compaq FTAM Responder

Attribute Group	Compaq Support
Kernel	X
Storage	X
Security	X
Private	

Attribute Support

Table 4-4 identifies the FTAM attributes that the Compaq responder supports and the type of support given—full or partial. In the case of fully supported attributes, the responder returns the current attribute value on a read-attribute request. When a

responder **partially supports** an attribute, it recognizes the attribute name as valid, but provides no value for it. In this case, any reference to that attribute yields the result that no value is available, and any attempt to change the attribute fails. For more information on levels of attribute support, refer to ISO 8571-2, clause 9.4. Note that Compaq files protected by the Compaq **Safeguard** system software security package have fewer fully supported attributes than files protected by the Guardian environment.

Table 4-4. Attributes Supported by the Compaq FTAM Responder

Attribute Group	File Attribute	Level of Support
Kernel	Filename	Full
	Permitted actions	Full
	Contents type	Full*
Storage	Storage account	Partial
	Date and time of creation	Partial if protected by Safeguard security software
		Full if protected by Guardian enviornment
	Date and time of last modification	Partial if protected by Safeguard security software
		Full if protected by Guardian enviornment
	Date and time of last read access	Partial if protected by Safeguard security software
		Full if protected by Guardian environment
	Date and time of last attribute modification	Partial
	Identity of creator	Partial if protected by Safeguard security software
		Full if protected by Guardian environment
	Identity of last modifier	Partial
	Identity of last reader	Partial
	Identity of last attribute modifier	Partial
	File availability	Full
	Filesize	Full
	Future filesize	Full

Table 4-4. Attributes Supported by the Compaq FTAM Responder (continued)

Attribute Group	File Attribute	Level of Support
Security	Access control	Partial if protected by Safeguard security software
	Legal qualifications	Partial
Private	Private use	Not supported

* In this context, full support applies to the contents type as a whole; it does not imply the support of all document types or all possible values of the parameters (maximum-string-length, universal-class, and string-significance) that further define the contents type.

Document Types

Table 4-5 identifies the FTAM document types that the Compaq responder supports and provides all supported values for associated contents-type parameters. The parameter values listed here are those directly supported; for information on the default values of these parameter values, see Table 4-7, later in this section.

Document types can be simplified to other document types with simpler structures. Simplification is the process of reading a file of a specific document type as a simpler document type. Relaxations—specifications that change the parameter values of a document type—are not permitted by Compaq FTAM. For more information on simplification and relaxation, see the subsection “Contents-Type Attribute,” later in this section.

The NBS-9 parameter value < filename > shown in Table 4-5 is the syntax notation for representing the value of a bit string. In this case, only the filename attribute bit is set.

Table 4-5. Document Types and Parameters Supported by the Compaq FTAM Responder

FTAM Document Types	Parameters	Parameter Values
FTAM-1	universal class	22, 25-27
	maximum-string-length	1 - 7148 (in bytes)
	string-significance	not-significant or Fixed or Variable
FTAM-2	universal class	22, 25-27
	maximum-string-length	1 - 4072* (in bytes)
	string-significance	not-significant
FTAM-3	maximum-string-length	1 - 4096 (in bytes)
	string-significance	not-significant

Table 4-5. Document Types and Parameters Supported by the Compaq FTAM Responder (continued)

FTAM Document Types	Parameters	Parameter Values
	maximum-string-length	1-4072 (in bytes)
	string-significance	fixed or variable**
NBS-9	Not applicable	<filename>***

FTAM-2 files are relative (sequential) files, and each logical record of a relative file can be a maximum of 4072 bytes. Each string is stored as a logical record in a relative file. Therefore, the practical size limit of a string during data transfer is 4072.

** If the string-significance parameter is set to fixed or variable, the file is an entry-sequenced file and is subject to the maximum logical record length of 4072 bytes. However, if a DEFINE by the name _ZOSF_FIXED_AS_UNSTRUCT exists when the FTAM processes are started then with the string-significance set to FIXED, the file will be an unstructured file with a maximum-string-length of 4096 bytes.

*** This value represents the Compaq FTAM responder default for NBS-9 files. If you open an NBS-9 file without specifying the file attributes to return, the Compaq responder defaults the parameter setting to the filename attribute only. If you do specify file attributes, the Compaq responder returns the specified file attributes.

Mapping Between FTAM Contents Types and Compaq File Structures

The FTAM virtual filestore (VFS) supports the Compaq responder by providing an interface to the Guardian file system. The Compaq implementation of the VFS maps Compaq FTAM file structures and attributes to Guardian file structures and attributes, and vice versa. Tables 4-6 and 4-7 show mappings of FTAM document types to file types.

Create Mappings

Table 4-6 shows the Guardian file structures created when you use the F-CREATE service to create FTAM files, provided either the file does not exist or the override parameter is set to delete and create with new attributes. (If the file exists and the override parameter is set either to select the old file or to create a new file with the old attributes, the existing file attributes are not checked and are left unchanged.) The table also shows the default parameter values for the FTAM-1, FTAM-2, and FTAM-3 document types. This table indicates the default parameter values for the document types that Compaq supports, whereas Table 4-5, earlier in this section, indicates the full range of parameter values for these document types.

For the create service to succeed, the maximum-string-length parameter is optional, because the ISO FTAM default value for this parameter, unbounded, is supported by the Compaq responder. Further, the value of the maximum-string-length parameter must

fall within the range supported by the Compaq responder for that document type and string-significance value, as follows:

Document Type	String-Significance Value	Maximum-String-Length Value
FTAM-1	not significant	1 <= maximum-string-length <= 7148
FTAM-1	fixed	1 <= maximum-string-length <= 7148
FTAM-1	variable	1 <= maximum-string-length <= 7148
FTAM-2	not significant	1 <= maximum-string-length <= 4072
FTAM-3	not significant	1 <= maximum-string-length <= 4096
FTAM-3	fixed	1 <= maximum-string-length <= 4072
FTAM-3	variable	1<= maximum-string-length <= 4072

If the maximum-string-length parameter is not specified or if the specified value does not fall within the defined range, the responder returns a negative confirm containing diagnostic message 1001, indicating unsupported parameter values.

Note that the Compaq responder does not keep a permanent record of the contents-type parameter values used on creation of a file in the VFS. These values are directly available only during the life of the FTAM association in which the file was created. When a remote initiator makes a create request followed by an open request and the open request specifies a contents type of unknown, the responder uses the contents-type parameter values specified in the create request. However, this information is lost when the association is terminated. On subsequent accesses to the file via a select request followed by an open request with a contents type of unknown, the responder uses its default values based on the Guardian file structure, as described in the next subsection, “Select-Open Mappings.”

Although Compaq FTAM supports the NBS-9 document type, it does not appear in Table 4-6 because Compaq FTAM cannot create NBS-9 files. The “NBS-9 Documents” subsection, later in this section, describes NBS-9 files in more detail. The Compaq responder also supports the NonStop Structured Query Language (**NonStop SQL**) table files for reading and writing. Compaq FTAM provides no support for creating SQL files.

Table 4-6. Create Mappings: FTAM Contents Type to Compaq File Structure

Contents Type		Compaq File Structure			
FTAM Document Types	**Default Parameter Values**	**Description**	**File Type***	**File Code**	**Record Length****
FTAM-1	universal-class = 25 (Graphic String) maximum-string-length = none*** string-significance = not-significant	Standard edit file	U	101****	Not applicable
FTAM-2	universal-class = 25 (GraphicString) maximum-string-length = none*** string-significance = not-significant	Enscribe relative file	R	0	maximum-string-length
FTAM-3	maximum-string-length = none*** string-significance = fixed	Enscribe entry-sequenced file	E	891	maximum-string-length
	maximum-string-length = none*** string-significance = variable	Enscribe entry-sequences file	E	892	maximum-string-length
	maximum-string-length = none*** string-significance = not-significant (defaults to not-significant if omitted)	Enscribe unstructured file	U	0	Not applicable

*The following values are possible for file type:

U = Enscribe unstructured
R = Enscribe relative
E = Enscribe entry-sequenced

**This is the standard Guardian file attribute that stands for the maximum record length.

***The maximum-string-length parameter must be specified.

****Line numbers are not preserved. If the value specified for the max-extents attribute is exceeded, max-extents is automatically increased (in increments, up to the system limit) and the lines renumbered.

The maximum number of lines allowed for file type 101 is 10,000,000. For more information, see the *Guardian Procedure Calls Reference Manual.*

Note. If a DEFINE by the name of _ZOSF_FIXED_AS_UNSTRUCT exists when the FTAM processes are started, and the string-significance parameter is set to FIXED in the request, the file created or selected will be an unstructured file with maximum-string-length of 4096 bytes.

Note. Though a default value for each parameter is proposed, if there are any user-defined default values available for particular combinations on a file type and file code, then that will override the system-defined default parameter values.

Select-Open Mappings

Table 4-7 shows the FTAM document types that correspond to each Compaq file type that can be selected, opened, and read. This table indicates the default parameter values for the document types that Compaq supports, whereas Table 4-5, earlier in this section, indicates the full range of parameter values for these document types.

When you issue a file-open request, you specify a contents-type parameter that provides the document type of the file and, optionally, parameter values that further define the document type. When a remote initiator sends a file-open request to the Compaq responder and specifies a contents type of unknown on the open request, the contents type returned by the responder yields the appropriate FTAM document type according to the requirements of the file system and as outlined in Table 4-7. If the file-open request indicates an FTAM document type (rather than unknown) for the contents type, the document type must generally be consistent with the mapping of Guardian file types to FTAM document types shown in Table 4-7. If the document type is not consistent with the values shown in Table 4-7, the responder returns a negative confirm that includes diagnostic message 5036, contents type inconsistent.

If the maximum-string-length parameter of the contents type is specified, the responder checks the proposed value before performing the select or open service. For the select or open to succeed, the value of the maximum-string-length parameter must fall within the range supported by the Compaq responder for that document type and string-significance value, as follows (where record length is the standard Guardian file attribute that stands for the maximum record length):

Document Type	String-Significance Value	Valid Maximum-String-Length Value(s)
FTAM-1	not-significant	1 <= maximum-string-length <= 7148
FTAM-2	not-significant	maximum-string-length <= record length
FTAM-3	not-significant	1 <= maximum-string-length <= 4096
FTAM-3	fixed	maximum-string-length = record length
FTAM-3	variable	maximum-string-length <= record length

If the proposed maximum-string-length value does not fall within the defined range, the responder returns a negative confirm containing diagnostic message 5036.

In addition, the contents type is an FTAM file attribute. When a remote FTAM initiator sends a read-attribute request, the value of the **contents-type attribute** that the Compaq responder returns is one of the FTAM document types listed in Table 4-7.

Table 4-7. Select-Open Mappings: Compaq File Structure to FTAM Contents Type

Compaq File Structure			Contents Type	
Description	**File Type***	**File Code**	**FTAM Document Types**	**Default Parameter Values**
Standard edit file	U	101****	FTAM-1	universal-class = 25 (Graphic String) maximum-string-length = 7148 string-significance = not-significant
Enscribe relative file	R	-	FTAM-2	universal-class = 25 (Graphic String) maximum-string-length = record length** string-significance = not-significant
SQL table, organization relative	R	-	FTAM-2	universal-class = 25 (Graphic String) maximum-string-length = record length** string-significance = not significant

Table 4-7. Select-Open Mappings: Compaq File Structure to FTAM Contents Type (continued)

Compaq File Structure			Contents Type	
Fixed-length binary file	E	891	FTAM-3	maximum-string-length = record length** string-significance = fixed
Variable-length binary file	E	892	FTAM-3	maximum-string-length = record length** string-significance = variable
Description	**File Type***	**File Code**	**FTAM Document Types**	**Default Parameter Values**
Unstructured file	U	All file codes except 101	FTAM-3	maximum-string-length =2048 string-significance = not significant
Non-SQL key-sequenced file	K	-	FTAM-3	maximum-string-length =2048 string-significance = not significant
Non-SQL entry-sequenced file	E	All file codes except 891, 892	FTAM-3	maximum-string-length =512 string-significance = not significant
Directory (selected by supplying a file name of "DIRLIS")	-	-	NBS-9	<filename>***
SQL table, not organization relative	K or E	-	Not supported; returned diagnostic = 3013	Not applicable

*The following values are possible for file type:

U = Enscribe unstructured
R = Relative
E = Entry-sequenced
K = Key-sequenced

**This is the standard Guardian file attribute that stands for the maximum record length.

***This value represents the Compaq responder default for NBS-9 files on an open. If you open an NBS-9 file without specifying the file attributes to return for the files in the directory, the Compaq responder defaults the parameter setting to the filename attribute only. If you do specify file attributes, the Compaq responder returns the specified file attributes for the files in the directory.

****Line numbers are not preserved. If the value specified for the max-extents attribute is exceeded, max-extents is automatically increased (in increments, up to the system limit) and the lines renumbered.

The maximum number of lines allowed for file type 101 is 10,000,000. For more information, see the *Guardian Procedure Calls Reference Manual*.

Note. If a DEFINE by the name of _ZOSF_FIXED_AS_UNSTRUCT exists when the FTAM processes are started, and the string-significance parameter is set to FIXED in the request, the file created or selected will be an unstructured file with maximum-string-length of 4096 bytes.

Note. Though a default value for each parameter is proposed, if there is a user-defined default value for a particular combination of a file type and file code, that user-defined value will override the system default.

Maximum-String-Length Checking of Data Values

The responder enforces strict rules on maximum-string-length checking. Every data value received or sent by the responder is checked according to the rules described below.

Write Operations

When writing data to the Guardian file system from the remote initiator, the responder checks the length of each string against the maximum-string-length value established for the file (the value proposed in the contents-type parameter of the open request or returned in the open confirm). The responder first removes any escape sequences contained in each string it receives before enforcing the maximum-string-length limitation.

If the string length is greater than the proposed maximum-string-length value, or if the string significance is fixed and the string length is less than the proposed value, the responder returns a cancel request containing diagnostic message 1007, indicating an unspecific FTAM protocol error.

Read Operations

The responder does no escape-sequence checking on the data it retrieves from the VFS and sends to the remote initiator; it simply counts all bytes and packages them into strings. For read operations on FTAM-3 files with a string-significance value of fixed, the responder does check for strings whose length is smaller than the maximum-string-length value. If any such strings are found, the responder returns a cancel request containing diagnostic message 5027, indicating a bad read.

Limits on Small String-Length Values With Large PDUs

When the Compaq responder receives data from a remote initiator, it decodes the data and stores it, as a sequence of strings, in an internal buffer with a maximum size of 25 KB. According to the NIST FTAM Phase 2 agreements, P-DATA carrying encoded FTAM PDUs or data elements cannot exceed 16 KB; however, string-header information in the buffer can cause the data in the buffer to be much larger than the maximum size of the encoded data. Because each string in the buffer includes a fixed number of bytes of header information, packing small strings into a large PDU can cause the 25 KB buffer size to be exceeded.

During data decoding, the responder checks the length of the data. If the decoded data cannot be accommodated in the 25 KB buffer, the responder generates a provider abort.

To avoid exceeding the buffer-size limit for writes to the Compaq responder, you can either send a smaller number of strings per PDU or send larger strings. Sending larger

strings may require you to increase the value of the maximum-string-length parameter in your requests. The following formula defines the conditions under which decoded data will fit into the buffer:

$$\sum_{i=0}^{NS-1} ((ZLEN)_i) + ((26 + PAD) * NS) <= 25600 \text{ bytes}$$

where

NS	=	number of character strings
ZLEN	=	length in bytes of a given character string
PAD	=	pad byte following string; if string length is even, PAD = 0; otherwise, PAD = 1
26	=	maximum data-header overhead per character string

When the responder retrieves data from the VFS in response to a read request, it automatically packages it into PDUs small enough to fit into its buffer. Therefore, no similar adjustments are necessary on read requests.

The formula for calculating the size of the encoded data is given below. This formula applies only to PDUs that contain primitive strings; PDUs containing constructed strings have additional overhead. As mentioned above, the encoded data limit is 16 KB.

$$\text{SIGMA}((ZLEN)_i) + ((TAG + LEN) * NS) <= 16384 \text{ bytes (16 KB)}$$

where

NS	=	number of character strings
ZLEN	=	length in bytes of a given character string
TAG	=	number of bytes used to encode the data tag
LEN	=	number of bytes used to encode length of string

Note. When the Compaq responder encodes data, the maximum encoded-data header overhead (TAG + LEN) is always 4 bytes per string. (The same is true for data encoded by the Compaq initiator.) An FTAM configurable file cannot be opened by the responder.

File-Attribute Mappings

The following subsection maps FTAM virtual filestore file attributes to specific Guardian and NonStop SQL file attributes. File attributes provide information for various aspects of a file, such as file name, file size, date and time of file creation, and so on.

Kernel Group File Attributes

Every FTAM implementation must fully support kernel file attributes. The kernel group includes the filename, **permitted-actions**, and contents-type attributes.

Filename Attribute

The filename attribute maps directly from the Compaq external file name to the FTAM VFS, with the exception of specifying NBS-9 files. For an explanation of the relationship between the filename attribute and NBS-9 files, see "NBS-9 Documents" later in this subsection.

Permitted-Actions Attribute

The **permitted-actions attribute** is a fixed list that specifies the actions that can be performed on an FTAM file. No Compaq file attribute corresponds to permitted-actions. When a remote initiator creates an FTAM file in the Compaq VFS, the Compaq responder always sets permitted-actions to fixed values. The fixed values selected depend on document type, as listed in Table 4-8. Although the remote application can specify permitted-actions in its file-create request, the values in Table 4-8 always override these values.

Table 4-8. Actions Permitted for FTAM Document Type

FTAM Document Types	Permitted Actions
FTAM-1	Read, replace, extend, erase, read-attribute, change-attribute, delete-file
FTAM-2	Read, insert, erase, read-attribute, change-attribute, delete-file, traversal, reverse-traversal, random-order
FTAM-3	Read, replace, extend, erase, read-attribute, change-attribute, delete-file
NBS-9	Read, read-attribute

Contents-Type Attribute

The contents-type attribute maps directly to Compaq file structures. Table 4-6, earlier in this section, lists the Compaq file structures (including file type and file code) created when you use the file-open service with any supported contents type except NBS-9. Table 4-7 shows how the responder maps Compaq files to the FTAM contents type when you open them with a contents-type value of unknown, or when you read the file attributes of the Compaq file.

When you open an existing file to read it, you can specify as part of the contents-type parameter a document type that is a simplification of the FTAM document type normally expected for that file. Document types can be simplified to other document types with simpler structures.

You can simplify document types only on read operations. This means that you must issue a read request immediately after your open request. If you issue a write request after an open request that requires a simplification, the responder returns a diagnostic message.

The responder allows for the simplification of FTAM-2 document types to FTAM-1 document types only. In addition, FTAM-2 simplification is allowed only on Compaq Enscribe relative files, not on SQL tables. Per the ISO 8571-2 provisions, the responder allows no simplification of FTAM-1 or FTAM-3 files.

Compaq FTAM does not permit the relaxation of document type parameters to less restrictive values. The VFS component of the responder keeps no record of the universal-class value associated with files created on the Guardian file system. In the case of the maximum-string-length parameter, the VFS records the maximum-string-length value for all FTAM-2 documents, and for FTAM-3 documents with a string-significance value of fixed or variable. For FTAM-1 documents, and for FTAM-3 documents with a string-significance value of not significant, the VFS has no memory of the associated maximum-string-length value.

Table 4-9 shows the simplification of document types that the responder allows.

Table 4-9. Simplification of Document Types Supported by the Compaq FTAM Responder

FTAM Document Type	Document Type Simplifications
FTAM-1	Not applicable
FTAM-2	FTAM-1 (Enscribe relative files only)
FTAM-3	Not applicable
NBS-9	Not applicable

NBS-9 Documents

NBS-9 documents are files that have been created by listing Guardian directories. If the remote initiator sends an F-SELECT primitive with a filename attribute of DIRLIS (all in uppercase), the Compaq responder returns a file of directory entries (an NBS-9 file) for the volume and subvolume specified in the filename attribute. The read and read-attribute actions are the only file actions that you can perform on an NBS-9 file. If a volume and subvolume are not specified, the responder uses the default volume and subvolume of the user specified in the initiator-identity parameter of the F-INITIALIZE request.

You can specify DIRLIS with volume or subvolume in any of the following ways:

- $*volume*.*subvol*.DIRLIS
- $*volume*.DIRLIS
- *subvol*.DIRLIS
- DIRLIS

Note. Because using 'DIRLIS' (uppercase) in the F-SELECT primitive returns the directory file, and Guardian file names are not case-sensitive, you should use "dirlis" (lowercase) in the F-SELECT primitive to select an actual file by this name rather than the directory file.

Each NBS-9 document has an attributes bit-string parameter. Each bit in this bit string identifies an individual file attribute. Table 4-10 shows the attributes that correspond to each bit.

Table 4-10. Bit String for NBS-9 File Attributes

Bit Numbers	Attributes
0	Filename
1	Permitted actions
2	Contents type
3	Storage account
4	Date and time of creation
5	Date and time of last modification
6	Date and time of last read access
7	Date and time of last attribute modification
8	Identity of creator
9	Identity of last modifier
10	Identity of last reader
11	Identity of last attribute modifier
12	File availability
13	Filesize
14	Future filesize
15	Access control
16	Legal qualifications
17	Private use

To control which attributes the responder returns when you read an NBS-9 file, set the bit string in the file-attributes field of the contents-type parameter on the F-OPEN

request primitive. This allows you to specify all or a subset of the attributes listed above. (Likewise, to control which attributes the responder returns when you read the attributes of an NBS-9 file, you set the bit string in the attribute-names parameter of the read-attribute request.) When you read the NBS-9 file, the responder returns only the attributes you select. If you do not specify this parameter, the responder returns only the filename attribute. For more information on the definition of the bit string in an NBS-9 directory file, refer to the NIST FTAM Phase 2 agreements, Part 9, Clause A.8.2.

Note. On Compaq systems, an NBS-9 file does not correspond to an actual physical Compaq file; therefore, the read-attribute action does not provide much useful information for NBS-9 files. The Compaq responder provides this service for NBS-9 files for interoperability, to support applications that perform a fixed sequence of services (for example, select, read-attribute, open, read) on any document type.

Storage Group File Attributes

Storage attributes are negotiated between a remote initiator and the local responder. The responder fully supports some storage attributes and partially supports others. If a partially supported attribute is referenced, the Compaq responder indicates that no value is available. You cannot change a partially supported attribute.

In the case of all four date-and-time attributes and the identity-of-creator attribute, if the file under consideration is protected by the Safeguard security software, the attribute in question is partially supported. The attribute is fully supported if the file is not protected by the Safeguard security software. The date-and-time attributes are maintained by the local file system.

The ISO 8571 standard defines two possible values for the **file-availability attribute**: immediate or deferred availability. The Compaq responder supports only immediate availability.

Filesize corresponds to the Guardian file attribute **EOF** (end-of-file), which returns the number of bytes in the file. Filesize is a read-only attribute and cannot be set.

The future-filesize attribute corresponds to a Guardian calculation—max-filesize—based on the Guardian file attributes primary extent size and secondary extent size. If the remote application reads the future-filesize attribute, the Compaq responder returns the max-filesize value. If the application writes the attribute, the responder changes the Guardian file attribute max-extents.

The formula for calculating max-filesize from the Guardian file attributes is as follows:

```
max-filesize = [primary extent size + ((max-extents - 1) *
   secondary extent size)] * 2048
```

where 2048 is the number of bytes in a page. (The primary and secondary extent sizes are expressed in pages, whereas max-filesize is expressed in bytes.)

When a file is created through the FTAM create service, the Guardian max-extents attribute is set to 16 if the future-filesize value is less than 1 MB, or to 512 if the future-filesize value is greater than or equal to 1 MB. Then the primary and secondary extent sizes are both set to the smallest integral multiple of 2 pages (4096 bytes) that will make the max-filesize value greater than or equal to the future-filesize value. If the future-

filesize parameter is not specified in a create request, the responder creates a file with a future-filesize value of 8 MB.

Subsequent change-attribute requests can change the value of max-extents. In all cases, the minimum value of max-extents is 16, and the maximum value is 978. The extent size cannot be changed.

Because of file-size limitations imposed by the Guardian file system, the Compaq responder cannot support all possible values of the future-filesize attribute sent in create and change-attribute requests. The Compaq responder creates files with a maximum future-filesize value of 1 GB. If a value greater than 1 GB is requested, the responder returns an informative diagnostic message and creates the file with a future-filesize value of 1 GB.

The smallest file the Compaq responder can create has a future-filesize value of 64 KB. If a smaller future-filesize value is requested, the responder creates the file with a future-filesize value of 64 KB. (Note, however, that the entire 64K is not necessarily allocated; only as many extents as needed are allocated.) No diagnostic message is returned in this case.

Note that the maximum size of files is limited by the physical storage capacity of the Compaq disk device being used. If an application attempts to write to a Compaq responder a file larger than 1 GB or larger than the disk device can hold, a file-system error 43 (unable to obtain disk space for file extent) will eventually occur in a WRITE call, and the Compaq responder will send a cancel to the application.

Table 4-11 summarizes the Compaq support for the storage attributes.

Table 4-11. FTAM Storage Attributes and Corresponding Compaq File Attributes

Storage Attributes	Level of Support	Compaq File Attributes
Storage account	Partial	
Date and time of creation	Partial if protected by Safeguard security software; Full if protected by Guardian environment	creation date-time for files other than NBS-9; current time for NBS-9
Date and time of last modification	Partial if protected by Safeguard security software; Full if protected by Guardian environment	last modification date-time for files other than NBS-9; current time for NBS-9
Date and time of last read access	Partial if protected by Safeguard security software; Full if protected by Guardian environment	last open date-time for files other than NBS-9; current time for NBS-9
Date and time of last attribute modification	Partial	

Table 4-11. FTAM Storage Attributes and Corresponding Compaq File Attributes (continued)

Storage Attributes	Level of Support	Compaq File Attributes
Identity of creator	Partial if protected by Safeguard security software or if document type is NBS-9; Full if protected by Guardian environment	owner
Identity of last modifier	Partial	
Identity of last reader	Partial	
Identity of last attribute modifier	Partial	
File availability	Full	always available
Filesize	Full for files other than NBS-9; Partial for NBS-9	eof-pointer
Future filesize	Full for files other than NBS-9; Partial for NBS-9	max-filesize (read attribute) max-extents (change attribute)

Security Group File Attributes

The remote responder and local initiator negotiate security attributes. The responder fully supports some security attributes while only partially supporting others. If a partially supported attribute is referenced, the Compaq responder indicates that no value is available. You cannot change a partially supported attribute. Table 4-12 shows Compaq support for security attributes.

Table 4-12. Security Attributes Supported by the Compaq FTAM Responder

Security Attributes	Level of Support
Access control	Partial if protected by Safeguard security software; Full if protected by Guardian environment*
Legal qualifications	Partial

*In accordance with ISO 8571-2, clause 12.16, the Compaq responder supports only a single action list for the access-control attribute.

Access-Control Attribute

The ISO FTAM **access-control attribute** is a set of access-control elements, with each element consisting of an action-list field and, optionally, concurrency-access, identity, passwords, and location fields. The access-control attribute defines the conditions under

which access to a file is allowed. ISO 8571-2 provides a complete description of the ISO FTAM access-control attribute.

Within the access-control attribute, the Compaq responder uses only the action-list field of the first access-control element; the concurrency-access, identity, passwords, and location fields are ignored, as are all access-control elements after the first.

Further, for Safeguard protected files, the access-control attribute is partially rather than fully supported. For these files, no mapping to Guardian security is attempted, and the responder indicates that no value is available when it reads the access-control attribute. In this case, attempts to change the attribute fail.

The following subsections explain how the Compaq FTAM responder uses the access-control attribute in three tasks requested by a remote initiating system: creating files, changing file attributes, and reading file attributes.

Creating Files. For files created through FTAM, the access-control attribute provided by the initiating system with the initial-attributes parameter in the F-CREATE request maps to Compaq file security (R W E P—Read Write Execute Purge). This mapping is as follows:

- The Compaq responder uses only the first access-control element. If more than one access-control element is present, the responder ignores all elements other than the first. The responder uses only the action-list field of the access-control element and returns a diagnostic message if the access-control element contains any other information (such as concurrency-access and identity).
- If the read access-control bit of the action list is set, the Compaq responder sets READ access to N, indicating that any user on the Expand network can read the file. Otherwise, the responder sets READ access to –, indicating that only the **super ID** user can read the file.
- If any of the insert, replace, **extend**, change-attribute, or erase access-control bits of the action list are set, the responder sets WRITE access to N, indicating that any user on the Expand network can write to the file. Otherwise, the responder sets WRITE access to –, indicating that only the super ID user can write to the file.
- EXECUTE access is set to –, indicating that only the super ID user can execute the file.
- If the delete-file access-control bit of the action list is set, the responder sets PURGE access to N, indicating that any user on the Expand network can purge the file. Otherwise, the responder sets PURGE access to –, indicating that only the super ID user can purge the file.

The mapping of FTAM action-list settings to Guardian security is summarized in Table 4-13.

Table 4-13. Mapping From FTAM Action List to Guardian Security

If action list is set to…	Guardian security is modified to…
Read	Set READ access to N
Insert	Set WRITE access to N
Replace	Set WRITE access to N
Extend	Set WRITE access to N
Erase	Set WRITE access to N
Read attributes	(no change)
Change attributes	Set WRITE access to N
Delete file	Set PURGE access to N

If the access-control attribute is not present in the F-CREATE indication, the Compaq responder sets Compaq file security to the default security allowed for the FTAM association, as defined by the **initiator-identity parameter** sent in the F-INITIALIZE request or by the default user **(DEFUSER)** attribute specified in the **VFS profile** configured for this responder.

Changing File Attributes. The access-control attribute can be modified through FTAM using the F-CHANGE-ATTRIB primitive. On the basis of the information a remote initiator sends in the F-CHANGE-ATTRIB request, the Compaq responder modifies the Guardian security of a file according to the functions it supports and returns a new value for the access-control attribute in the F-CHANGE-ATTRIB response. The Compaq responder access-control attribute is limited to a single access-control element.

In the F-CHANGE-ATTRIB request sent by the initiating system, the values for access control consist of insert-values or delete-values (or both), each of which can be zero, one, or more access-control elements. The Compaq responder, however, processes only the first access-control element sent for insert-values and for delete-values.
The Compaq responder also ignores all but the first component of the insert-values or delete-values information, using only the action-list information to modify Guardian security (R W E P) for the file. If the initiating application attempts to change any other components of access control (such as concurrency-access, location, or identity), the Compaq responder returns a diagnostic message.

Insert-values and delete-values turn access to the actions in the action list on and off, respectively. Because the access-control attribute can indicate both insert-values and delete-values, you might unintentionally specify the same action in both values. If this occurs, the delete-values action overrides the insert-values action.

The following rules apply to changing the access-control attribute:

For insert-values:

- If the read access-control bit of the action list is set, the responder sets READ access to N, indicating that any user on the Expand network can read the file.

- If any of the insert, replace, extend, change-attribute, or erase access-control bits of the action list are set, the responder sets WRITE access to N, indicating that any user on the Expand network can write to the file.
- If the delete-file access-control bit of the action list is set, the responder sets PURGE access to N, indicating that any user on the Expand network can purge the file.

For delete-values:

- If the read access-control bit of the action list is set, the responder sets READ access to –, indicating that only the super ID user can read the file.
- If all of the insert, replace, extend, change-attribute, or erase access-control bits of the action list are set, the responder sets WRITE access to –, indicating that only the super ID user can write to the file. If only some of these access-control bits are set, there is no change.
- If the delete-file access-control bit of the action list is set, the responder sets PURGE access to –, indicating that only the super ID user can purge the file.

Note. EXECUTE access is always set to –, indicating that only the super ID user can execute the file.

Reading File Attributes. When the Compaq responder reads FTAM file attributes for document types other than NBS-9, it maps the values for access control from Guardian security based on the user ID for the association, as defined by the initiator-identity parameter sent in the F-INITIALIZE request or by the DEFUSER attribute specified in the VFS profile configured for this responder. This mapping shows which actions that user can perform. (For NBS-9 files, the action list on a read-attribute action is always [read, read-attribute]).

The user has specific access (READ, WRITE, EXECUTE, or PURGE) to a file if one of the following applies:

- User is super ID, and file is on the same Expand **node** as the responder.
- Guardian security is N.
- Guardian security is A, and file is on the same Expand node as the responder.
- Guardian security is C, and user is in the same group as the owner of the file.
- Guardian security is G, and user is in the same group as the owner of the file, and file is on the same Expand node as the responder.
- Guardian security is U, and user is the owner of the file.
- Guardian security is O, user is the owner of the file, and file is on the same Expand node as the responder.

The Compaq responder sets the individual bits of the action list according to the Guardian access allowed for the user. Table 4-14 shows how Guardian security maps to FTAM action-list settings.

Table 4-14. Mapping From Guardian Security to FTAM Action List

Guardian Access	Action-List Bits Set
READ	Read
WRITE	Insert, Replace, Extend, Erase, Change-attribute
EXECUTE	No effect on access control
PURGE	Delete-file

The read-attribute bit is always set.

Legal-Qualifications Attribute

The legal-qualifications attribute conveys information about the legal status of the file and its use. This attribute is partially supported.

Private Group File Attributes

Compaq FTAM does not support **private group** file attributes.Supported and Unsupported Optional ParametersSupported and Unsupported Optional Parameters

Supported and Unsupported Optional Parameters

Table 4-15 indicates the level of support provided by the Compaq responder for the optional parameters received in request PDUs. It shows what action the Compaq responder performs on the optional parameters received from a remote initiator.

Table 4-15. Compaq Support of Optional Parameters Received in Request PDUs

Parameters	Level of Compaq Support
Implementation information	Decoded and ignored.
Shared ASE information	Decoded and ignored.
Contents type list	Supported. Only the following document types are accepted on the response: FTAM-1, FTAM-2, FTAM-3, NBS-9. Only the abstract syntaxes required for those document types are accepted.
Initiator identity	Supported. Used to set the Compaq user. Either the user name (*group_name.user_name*), or user ID (*group_no, user_no*) form is allowed.
Account	Decoded and ignored.
Filestore password	Supported. Used in conjunction with initiator-identity parameter to authenticate the Compaq user.

Table 4-15. Compaq Support of Optional Parameters Received in Request PDUs (continued)

Parameters	Level of Compaq Support
Diagnostic	Decoded and ignored.
Access passwords	Decoded and ignored.
Concurrency control	Decoded and ignored.
Create password	Decoded and ignored.
Activity identifier	Decoded and ignored.
Remove contexts	Decoded and ignored.
Define contexts	Decoded and ignored.
FADU lock	Decoded and ignored.

Table 4-16 shows which optional parameters the Compaq responder can return in a response PDU.

Table 4-16. Compaq Support of Optional Parameters Sent in Response PDUs

Parameters	Level of Compaq Support
Implementation information	Not returned.
Shared ASE information	Not returned.
Contents type list	Returned with list reduced to document types supported by responder.
Diagnostic	Always returned when action-result parameter is not equal to zero. Sometimes returned (informative diagnostic messages) when action-result parameter equals zero.
Charging	Not returned.
Attributes	See “File-Attribute Mappings,” earlier in this section, for details of support.
FADU identity	Not returned.

File-Access and Security Considerations

The VFS controls access to files through normal Guardian security mechanisms. Each FTAM association has a Compaq user ID associated with it. This user ID can assume two values, depending on whether the **initiator-identity parameter** is supplied in the F-INITIALIZE request primitive. If the initiator-identity parameter is supplied, this parameter provides the user ID value. If the initiator-identity parameter is omitted, the user ID becomes the default user configured via the DEFUSER attribute for the VFS profile used by the responder. In either case, the password can be used. The **filestore-password parameter** of the F-INITIALIZE request primitive supplies the password used to authenticate the initiator identity. DEFUSER includes both the user ID and the

password. For details on configuring a default user, refer to the *OSI/FTAM Configuration and Management Manual*.

The VFS actions allowed by the FTAM responder depend on the Guardian security (R W E P) for a file and the user ID for the association. For example, if you have Compaq purge access to a given file, the responder allows the FTAM delete-file action. Table 4-17 shows the Guardian access required for each FTAM VFS action.

Table 4-17. Guardian Access Required to Perform FTAM Actions

FTAM VFS Action	Guardian File Access Required	Guardian Exclusion Mode
Read	READ	SHARED
Insert	WRITE	EXCLUSIVE
Replace	WRITE (READ also required for EDIT files)	EXCLUSIVE
Extend	WRITE (READ also required for EDIT files)	EXCLUSIVE
Erase	WRITE	EXCLUSIVE
Read attributes	None	SHARED
Change attributes	WRITE	EXCLUSIVE
Delete file	PURGE	EXCLUSIVE

Note. The Compaq EXECUTE access for a file has no bearing on FTAM access.

Refer to the Compaq *File Utility Program (FUP) Reference Manual*, the Compaq *Enscribe Programmer's Guide*, and, if your files are Safeguard protected, the Compaq *Safeguard Reference Manual* for information about setting READ, WRITE, and PURGE access to a file.

Because the Compaq responder runs under the user ID for an association, Guardian security and Safeguard security are both enforced. The responder cannot translate Safeguard security attributes into the FTAM access-control attribute. Therefore, when a remote application reads the attributes of a file that the Safeguard software protects, the access-control attribute indicates that no value is available. However, the Safeguard software still protects FTAM access to the file. Note that for such a file, the read-attribute action does not tell you which file-access actions you may perform.

If a file-access request is rejected because the user ID does not meet the Guardian security requirements of the file, the responder sends a diagnostic message to the application, and also generates an EMS **event message** indicating a security violation on a file-access attempt.

Table 4-17 shows the exclusion mode that applies to each FTAM VFS action. Files open for read actions are open for SHARED access, allowing more than one user to open a file concurrently for reading. Files open for insert, replace, extend, and erase

actions are open for EXCLUSIVE access; only one user at a time can open a file for writing. Where a combination of VFS actions are performed on a file, that file's exclusion mode is EXCLUSIVE if any one of the actions qualify the file's exclusion mode as EXCLUSIVE. If a file access is attempted on a file already opened for EXCLUSIVE access, the responder returns a diagnostic message to the remote application in the F-OPEN confirm.

5

Suggestions for Development of Remote Applications

When you write an FTAM application that uses the services of the Compaq responder, how you design, code, and debug it depends largely on the interface you are using on the remote system. However, there are some general things you should consider to make the most effective use of the Compaq FTAM responder. This section briefly discusses application development considerations for the design and programming phases of your project and for the troubleshooting phase.

Design and Programming

In designing your application, you should first consider interoperability with the other FTAM implementation you are using. In the coding phase, build error handling into your application, taking advantage of the information provided by the Compaq responder in diagnostic messages.

Interoperability

Before writing your application, you should read Section 2 of this manual, "Conformance and Interoperability," which describes certain aspects of the Compaq FTAM responder that can affect its ability to interoperate with other FTAM implementations. Compare the information in Section 2 to the characteristics of the remote FTAM implementation. Pay special attention to the following:

- Service classes, functional units, and attributes supported
- Future-filesize limitations
- Maximum-string-length limitations
- String-significance values supported
- Use of format effectors, including carriage return/line feed pairs
- Character sets

Existing applications being adapted to use the Compaq responder might need some modifications in these areas.

Error Handling

To ensure that you receive as much information as possible about application problems if they occur, your applications should follow a good error-handling strategy. In general, you should check for status and error information after each FTAM operation you request in your program, and then provide some means of reporting errors.

The Compaq FTAM responder returns diagnostic messages to your application as specified by the ISO 8571 standard. In many cases, more information is returned than is required by the standard. Appendix A, "Compaq FTAM Responder Diagnostic Messages," provides cause, effect, and recovery information about all diagnostic messages returned by the responder.

Some responder diagnostic messages also contain text of up to 256 characters in the Further Details field, providing additional information on the nature of the problem. For example, if you attempt to create a file and receive diagnostic message 3006 (file cannot be created), the Further Details text provides the file-system error number returned by Guardian when the file creation attempt failed. A Compaq problem solver or someone else with access to the Compaq system can look up this number in the *Guardian Procedure Errors and Messages Manual* to obtain information on what occurred and how to correct the problem.

As another example, if you attempt to open a file and receive diagnostic message 5036 (contents type inconsistent), the Further Details text "illegal MSL value" indicates that you attempted to open a file with a maximum-string-length parameter value outside the range supported by the Compaq FTAM responder, as described under "Mapping Between FTAM Contents Types and Compaq File Structures" in Section 4.

It is recommended that you check Further Details whenever you receive a diagnostic message. The Further Details text for many messages is self-explanatory and is not described in Appendix A.

Troubleshooting

To detect and eliminate problems in your remote application, you need to use whatever debugging tools are available on the remote system. However, there are also troubleshooting tools available on the Compaq system where the responder runs that can provide additional information about a problem. If you encounter interoperability problems or other problems that appear to originate on the Compaq system, you should work with a Compaq problem solver who has access to these tools.

The Compaq troubleshooting tools include the following:

- The Event Management Service (EMS) log
- Subystem Control Facility (SCF) interactive interface
- The PTrace utility

The Event Management Service (EMS) on Compaq systems enables the Compaq problem solver to monitor problems and other significant events that occur during the operation of Compaq FTAM and other Compaq software. The FTAM responder and the **APLMGR process** that manages it generate event messages when they detect significant **events**, as do the processes in the underlying OSI/AS, OSI/TS, X25AM, and TLAM (or PAM for G06 and above releases) and TCP/IP subsystems. Event messages are logged to the console or displayed on a terminal as **operator messages**, which are described in the *Operator Messages Manual*.

The Compaq problem solver can use SCF commands to display configuration, status, and statistics information about the responder and APLMGR processes on the Compaq system. This information can sometimes provide clues to the cause of a problem, especially if an association is not yet established or if there are problems with system capacity or performance. In addition the STATUS SU command, which provides information about an FTAM association once it is established, can be especially useful in troubleshooting.

The PTrace (print trace) utility allows the Compaq problem solver to look at trace data generated with the SCF TRACE command. The TRACE command provides a log of message traffic between the various processes running on the Compaq system; PTrace displays the contents of these messages, including the types and contents of protocol data units (PDUs). Problems that can be detected using TRACE and PTrace include interoperability problems and various application protocol problems.

Additional guidance for the Compaq problem solver is provided in the troubleshooting section of the *OSI/FTAM Configuration and Management Manual*.

6 Responder Manager

This section discusses considerations that are related to the configuration and management of the responder process and its VFS on the Compaq system, but that you might need to know when writing or using FTAM applications on the remote system. It covers the following topics:

- Notes on configuration
- Fault tolerance
- Event messages

Full details on FTAM configuration, management, and troubleshooting on the Compaq system are provided in the *OSI/FTAM Configuration and Management Manual*.

Notes on Configuration

Compaq FTAM (responder and **APLMGR** processes), the OSI/AS subsystem, the OSI/TS subsystem, and TLAM (or PAM for G06 and above releases) or X25AM or TCP/IP must be configured and running on the Compaq system before your application can communicate with the Compaq responder.

Because of the flexibility, and resultant complexity, of the configuration of underlying Compaq OSI layers, configuration errors are a common cause of problems in Compaq FTAM applications. The Compaq problem solver should pay special attention to checking the configuration of Compaq FTAM and the configuration of the underlying OSI layers (via Compaq OSI/AS).

The following aspects of configuration are important to writers and users of remote FTAM applications:

- **OSI address** of responder
- Initiator-identity and filestore-password parameters
- Protocol error counter
- Ways to increase responder capacity
- Ways to increase responder performance

OSI Address of Responder

The assigned OSI address of each responder process is configured on the Compaq system. Remote applications must refer to this address when requesting the services of the responder. Several responders can be assigned to the same address.

Initiator-Identity and Filestore-Password Parameters

The initiator-identity and filestore-password parameters in the F-INITIALIZE request correspond, respectively, to the Guardian user ID and password on the Compaq system. Optionally, a default user ID and password can be set up in the Compaq FTAM configuration, allowing remote applications access to the responder and its VFS without sending a user ID and password across the network.

If defaults are not configured, your application must specify a Guardian user ID that allows access to the files in the VFS, along with its associated password.

Protocol-Error Counter

A protocol-error counter, whose value is configurable, specifies how many FTAM protocol errors must occur before an event message is generated on the Compaq system. These event messages can alert the Compaq problem solver to interoperability problems.

Increasing Responder Capacity

The Compaq system manager can increase responder capacity by doing one of the following:

- Increasing the maximum number of associations or attaches per responder process
- Adding more responder processes

Increasing Responder Performance

The system manager can often increase system performance or throughput by doing one or more of the following:

- Configuring responder processes to run in different Compaq CPUs
- Specifying a less fully occupied disk as the process **swap volume**
- Adjusting the **execution priority** of various processes
- Adjusting some of the parameters in the underlying OSI/AS configuration

Fault Tolerance

Compaq FTAM provides some **fault tolerance** if responder processes are configured to run as NonStop **process pairs**, consisting of a **primary process** and **a backup process**. When processes run as NonStop process pairs, the startup configuration information for the primary process is **checkpointed**. If a hardware or software component fails, the backup process takes over.

If the primary responder process fails, all outstanding Compaq FTAM associations, as well as the associated OSI/AS **connections**, are aborted. The remote initiator receives an F-P-ABORT indication. After a delay, the remote FTAM application can retry establishing the association.

If the Compaq FTAM responder process is running as a NonStop process pair, the backup Compaq FTAM responder process takes over, and your remote application must reinitiate its Compaq FTAM associations. You or your application should then check and verify all previous work performed using the Compaq responder, correct inappropriate file states left from the component failure, and proceed as appropriate to the needs of your application.

The process of verifying work performed before a hardware or software component failure and recovering from unknown file states is different for every application. The main recovery strategies depend on the type of activity in progress during component failure:

- Reading from a file
- Writing to a file that your application created
- Writing to a file that already existed

In the case of reading a file, no recovery is necessary. The Compaq responder does not modify files opened for reading only.

In the case of writing to a file, you should probably consider the file unusable. If you created the original file, the best recovery might be to delete the unusable file and recreate it. If you were writing to a file that you did not create and whose contents you cannot retrieve—from a file backup, for example—recovery might not be possible. You should design your application (making backups where necessary) with this in mind.

FTAM configurable files cannot be opened by the responder.

Event Messages

The Event Management Service (EMS) on Compaq systems enables the Compaq problem solver to monitor problems and other significant events that occur during the operation of Compaq FTAM and other Compaq software.

Whenever a Compaq process such as the FTAM responder detects an event that might affect its operation, it generates an event message describing the event. Such event messages can be related to hardware or software malfunctions, or to important changes in the state of a system component. Text (readable) versions of these event messages can be displayed as operator messages: for example, in an operator console log or on a terminal running the **ViewPoint operations console application**. For detailed information on the event messages sent by Compaq FTAM processes, see the OSIFTAM and OSIAPLMGR sections of the *Operator Messages Manual*.

Event messages generated by FTAM responder and APLMGR processes can alert the Compaq problem solver to the following kinds of problems:

- System problems such as CPU failures, process failures, and unavailability of system resources such as LCBs
- Interoperability problems that cause protocol-error thresholds to be exceeded
- Configuration problems, such as mismatches between the common names and OSI addresses configured in the APLMGR MIB and those in the OSI manager MIB

- Failure to establish an association with a Compaq responder due to an invalid initiator ID or password
- Compaq responder virtual filestore (VFS) file-access failures due to file-system errors or security violations

The responder also returns an event message whenever it starts or completes a file transfer, indicating whether or not the transfer was successful. This event can be monitored to verify completion of a transfer, so that your application can be notified when it can proceed with the next operation.

A

Compaq FTAM Responder Diagnostic Messages

The Compaq FTAM responder diagnostic messages can be returned in indications and confirms to an initiating FTAM implementation that requested the Compaq FTAM responder to execute a service that it cannot perform. They can also be returned to provide additional information on a successful action. Those troubleshooting FTAM applications using the Compaq responder can use these diagnostic messages to understand why a requested action has failed or to qualify a successful action. This appendix gives a detailed explanation of each diagnostic message, including cause, effect, and recovery information.

This appendix is intended for those who are writing, using, or troubleshooting an FTAM application running over a remote initiator that interoperates with the Compaq FTAM responder. In some cases, the problem lies on the initiating system; in other cases, the problem is on the Compaq system (for example, in the responder configuration). The recovery-action descriptions indicate whether an action is to be taken by the application or interactive FTAM user on the initiating system, or by the Compaq problem solver on the Compaq system. For problems that lie on the initiating system, it may be useful to notify the remote initiator site when error conditions occur in case the remote application does not check for returned diagnostics.

A table listing the diagnostic messages of a particular group precedes the detailed explanations. Each table lists the messages numerically by error identifier and includes information about the type, or severity of the error, and the observer and source of the error. Table A-1 lists the diagnostic message types and indicates the severity of each; Table A-2 lists valid **error observer** and **error source** values.

Table A-1. Diagnostic Message Types

Type	Description
0	Informative: requires no recovery, and the current state of the file service is not affected. Message provides information to qualify a successful action.
1	Transient: can reoccur if the sequence of events is repeated and implies the failure of the operation being performed.
2	Permanent: occurs every time the sequence of events is repeated and implies the failure of at least the present operation being performed.

Table A-2. Sources and Observers of Errors

Source/Observer Identifier	Description
0	Source of the error cannot be identified. This identifier is not valid for the observer.
1	Initiating file-service user (initiating application).
2	Initiating file protocol machine.
3	Service supporting the protocol machines. This identifier is not valid for the observer.
4	Responding file protocol machine.
5	Responding file-service user (VFS or file system).

The detailed descriptions of the diagnostic messages that follow each summary table are also listed numerically by the error identifier. In addition to the information provided in this appendix, responder diagnostic messages might also contain text of up to 256 characters in the Further Details fields, providing additional information on the nature of the problem.

General FTAM Diagnostic Messages

Table A-3 displays the general **error identifiers** returned by the Compaq FTAM responder.

Table A-3. General FTAM Diagnostic Messages

Identifier	Type	Observer	Source	Reason
1	2	5	5	Unspecific responder error
7	0	5	1	Unspecific initiator error
8	1	4	4	Subsequent error
9	2	4,5	4,5	Temporal insufficiency of resources

1

```
Unspecific responder error
```

Cause. Either the combination of a small maximum-string-length value and a large PDU size caused the incoming data to exceed the responder’s data buffer capacity, or an internal software error has occurred in the responder.

Effect. The responder aborts the association. If the data buffer capacity was exceeded for the reason given under "Cause," the Further Details field contains the message smaller PDU or larger MSL needed.

Recovery. If the Further Details field indicates that a smaller PDU or a larger MSL is needed, the application or FTAM user should decrease the number of strings sent in one PDU. This can be done either by sending a smaller number of strings per PDU or by sending larger strings. Sending larger strings may require increasing the value of the maximum-string-length parameter in the application's requests. For further information, refer to "Limits on Small String-Length Values With Large PDUs" in Section 4.

Otherwise, the application or FTAM user should retry the operation. This can be a transient condition. If the condition persists, the Compaq problem solver should trace the responder and follow the standard procedures at the Compaq site for contacting the appropriate support personnel. These procedures might involve contacting the local Compaq support analyst. For details on how to trace the responder, refer to the *SCF Reference Manual for FTAM and APLMGR* and the Compaq *PTrace Reference Manual*.

7

```
Unspecific initiator error
```

Cause. The responder received a change-attribute indication containing a null proposed change-attribute list.

Effect. This is an information-only diagnostic message. The service is completed; no attributes are changed.

Recovery. No action is necessary.

8

```
Subsequent error
```

Cause. In a grouped request, one of the requests after the one on which the responder returns this diagnostic message has encountered an error condition.

Effect. The responder rejects the grouped request.

Recovery. The application programmer or FTAM user should determine which request in the group failed and correct the problem.

9

```
Temporal insufficiency of resources
```

Cause. The responder has attempted to allocate memory for a data control block, but the memory table does not have sufficient space to satisfy the request.

Effect. The responder aborts the association.

Recovery. The application or FTAM user should retry the operation. This can be a transient condition. If the condition persists, the Compaq problem solver can start another FTAM responder process to balance the load across multiple responder processes. For details on how to configure and start additional responders, refer to the *SCF Reference Manual for FTAM and APLMGR* and the *OSI/FTAM Configuration and Management Manual*.

11

```
Access request violates local security
```

Cause. A file has been selected with requested access that violates the file system security. A file-system security violation (48) was detected.

Effect. The responder rejects the select or create request and generates a security-fail event (event number 21).

Recovery. The application or FTAM user can either retry with the correct select-request or create-request parameters, or use initiator-ID and filestore-password values that support the requested access; or the Compaq problem solver can change the local Compaq security for the file.

Protocol and Supporting Service-Related Diagnostic Messages

Table A-4 displays the diagnostic error identifiers caused by protocol errors or improper requests for supporting services.

Table A-4. Protocol and Supporting Service-Related Diagnostic Messages

Identifier	Type	Observer	Source	Reason
1001	2	4	2	Unsupported parameter values
1002	2	4	2	Mandatory parameter not set
1007	2	4	2	Unspecific FTAM protocol error
1009	2	4	2	FTAM protocol error, functional unit error
1011	2	4	3	Lower-layer failure
1015	2	4	2	Illegal grouping sequence
1016	2	4	2	Grouping threshold violation
1017	2	4	2	Specific PDU request inconsistent with current requested access

1001

```
Unsupported parameter values
```

Cause. A request contained a parameter value that the Compaq FTAM responder did not support: for example, the override parameter did not equal one of the values supported by the Compaq responder, the maximum-string-length value was not in the range expected by the Compaq responder or was not specified (the ISO FTAM default, unbounded, is not supported by the Compaq responder), or the protocol version specified in the initialize request was not version 1.

Effect. The responder does not perform the requested operation.

Recovery. The application or FTAM user should retry the request providing parameter values that the responder supports. For information about parameters that the Compaq FTAM responder supports, see Section 4.

1002

```
Mandatory parameter not set
```

Cause. The responder received a request PDU that did not contain all the required parameters, or the request was malformed. Any request PDU that has mandatory parameters can cause the responder to return this diagnostic message.

Effect. The responder aborts the association.

Recovery. The application or FTAM user should retry the request with all mandatory parameters. To determine which parameters are mandatory, refer to the FTAM PDU definitions for FTAM in ISO 8571-4.

1007

```
Unspecific FTAM protocol error
```

Cause. The responder detected a protocol error. One possible error on a write is a data value that does not conform to the maximum-string-length value established for the file.

Effect. The responder aborts the association. If the protocol error threshold (a value set via the THRESHOLD attribute during responder configuration) has been exceeded, the responder generates a protocol-error-threshold event (event number 22). If the problem was an attempt to write a data value that does not conform to the maximum-string-length value for the file, the Further Details field contains the message string length violates the MSL.

Recovery. This can be an interoperability problem. Verify that the initiator is issuing a valid request to the responder. The Compaq problem solver can do this by tracing the responder and verifying the protocol. For information on tracing, refer to the *SCF Reference Manual for FTAM and APLMGR* and the *OSI/FTAM Configuration and Management Manual.*

1009

```
FTAM protocol error, functional unit error
```

Cause. The responder received a service request that requires a functional unit that was not negotiated when the association was established.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should establish a new association and negotiate the required functional units.

1011

```
Lower-layer failure
```

Cause. The responder detected an error in communicating with a TAPS process.

Effect. The responder aborts the association.

Recovery. The application or FTAM user should discard the association context, reestablish the association, and retry the operation. If the problem persists, the Compaq problem solver should verify that the TAPS process is configured properly and trace the responder. The Compaq problem solver should examine the status, error code, error subcode, and original error information displayed in the trace record. This information should help identify the problem being detected by the TAPS process.

For information on configuration and on tracing the responder, refer to the *OSI/FTAM Configuration and Management Manual* and the *SCF Reference Manual for FTAM and APLMGR*.

1015

```
Illegal grouping sequence
```

Cause. The grouped service contains an illegal primitive, or this particular grouping is not allowed for the negotiated service class.

Effect. The responder does not perform the grouped service, no services are performed, and the responder aborts the association.

Recovery. The application or FTAM user should retry using a valid group for the negotiated service class.

1016

```
Grouping threshold violation
```

Cause. The threshold—the number of primitives that must be completed successfully before the group can be considered successful—is greater than the number of services in the group, or the threshold for a group associated with any service class other than file

access is less than the number of services in the group. (Only the file-access service class allows a threshold of less than the number of services in the group, allowing a group of primitives to provide some service even if one of the primitives fails.)

Effect. The responder aborts the association.

Recovery. The application or FTAM user should discard the association context, reestablish the association, and retry the operation with a group having the proper value for the threshold parameter.

1017

```
Specific PDU request inconsistent with the current requested access
```

Cause. A service has been attempted that is inconsistent with the current requested access.

Effect. The responder does not perform the service.

Recovery. The application or FTAM user should reselect the file with the required requested access and retry. If the problem persists, the Compaq problem solver can use the SCF TRACE command and the PTrace utility to troubleshoot the problem. For more information on tracing and troubleshooting, refer to the *OSI/FTAM Configuration and Management Manual*.Association-Related Diagnostic Messages

Association-Related Diagnostic Messages

Table A-5 displays the diagnostic error identifiers related to managing associations.

Table A-5. Association-Related Diagnostic Messages

Identifier	Type	Observer	Source	Reason
2002	2	4	1	Unsupported service class
2003	2	4	1	Unsupported functional unit
2013	0	4	2	Checkpoint window error (unsupported)
2014	0	3	2	Communications ftam-quality-of-service not supported
2015	2	5	1	Initiator identity unacceptable
2016	0	4	1	Context management refused
2018	0	5	1	Contents type list cut by responder
2020	2	5	1	Invalid file store password
2021	2	4	1	Incompatible service classes

2002

```
Unsupported service class
```

Cause. The responder received an initialize request for the unconstrained service class. The Compaq FTAM implementation does not support the unconstrained service class.

Effect. The association is not established.

Recovery. The application or FTAM user should specify a supported service class on the initialize request. For a list of service classes that Compaq FTAM supports, see Section 4.

2003

```
Unsupported functional unit
```

Cause. Requested functional units were inconsistent with the service class negotiated.

Effect. The association is not established.

Recovery. The application or FTAM user should specify functional units that are consistent with the proposed service class on the initialize request.

2013

```
Checkpoint window error (unsupported)
```

Cause. The checkpoint-window parameter of the initialize request was set to a value that the responder does not support. The responder expects a value of 1.

Effect. This is an information-only diagnostic message returned in the initialize response. The association is established.

Recovery. No action is required.

2014

```
Communications ftam-quality-of-service not supported
```

Cause. The responder does not support the value of the FTAM quality-of-service parameter on the initialize request. The responder supports only a value of "no recovery" for this PDU parameter.

Effect. This is an information-only diagnostic message returned in the initialize response. The association is established.

Recovery. No action is required.

2015

```
Initiator identity unacceptable
```

Cause. The initiator-identity parameter in the initialize request was invalid, or it was omitted and there was no default user ID/password configured for the responder.

Effect. The association is not established. The responder generates the password-failure event (event number 20).

Recovery. Either the application or FTAM user should retry with a valid initiator identity, or the Compaq problem solver should configure the responder to have a default user ID/password. Change the VFS profile for the responder to define a DEFUSER attribute. Refer to the ALTER PROFILE command description in the *SCF Reference Manual for FTAM and APLMGR*.

2016

```
Context management refused
```

Cause. The remote initiator has set the presentation-context-management parameter to true on the F-INITIALIZE service. The Compaq responder does not support the presentation-context-management parameter.

Effect. This is an information-only diagnostic message. The association is established.

Recovery. No action is necessary.

2018

```
Contents type list cut by responder
```

Cause. The responder detected one or more inconsistent or unsupported presentation contexts in the contents-type-list on the initialize service.

Effect. This message is a warning. The responder disregards the contents types that it does not support or are not valid and retains those that are. The association is established with a partial contents-type-list.

Recovery. The application or FTAM user should investigate the resulting list to determine if needed contents types are still included. If not, interoperability of the two FTAM implementations is limited and might prevent you from using FTAM to accomplish your purpose. The responder supports only the FTAM-1, FTAM-2, FTAM-3, and NBS-9 document types.

2020

```
Invalid filestore password
```

Cause. The password on the initialize request is invalid, or an invalid default password is configured for the Compaq responder.

Effect. The association is not established. The responder generates the password-fail event (event number 20).

Recovery. For the first cause, the application or FTAM user should retry the request using a valid password; for the second cause, the Compaq problem solver should correct the default password by reconfiguring the DEFUSER attribute in the responder's VFS profile on the Compaq system.

2021

```
Incompatible service classes
```

Cause. The responder can return this diagnostic message in two conditions:

- In examining the initiate indication, the responder detected either a value of unconstrained for the service class or no value at all for the service class.
- The remote initiator requested services requiring the management service class, but the management service class was not negotiated on the F-INITIALIZE request.

Effect. For the first cause, the association is not established. For the second cause, the responder aborts the association.

Recovery. The application or FTAM user should reestablish the association negotiating values for service class and functional units that are valid for the responder and that support the requests being made.

Selection-Related Diagnostic Messages

Table A-6 displays the diagnostic error identifiers generated while selecting a file or negotiating a service.

Table A-6. Selection-Related Diagnostic Messages

Value	Type	Observer	Source	Meaning
3000	2	5	5	File name not found
3002	2	5	5	Initial attributes not possible
3004	2	5	5	Non-existent file
3005	2	5	5	File already exists
3006	2	5	5	File cannot be created
3007	2	5	5	File cannot be deleted
3012	2	5	5	File busy
3013	2	5	5	File not available
3016	2	5	5	Access control inconsistent
3018	0	5	1	Initial attributes altered
3020	0	5	5	Override selected existing file
3021	0	5	5	Override deleted and recreated file with old attributes
3022	0	5	5	Create override deleted and recreated file with new attributes
3027	2	5	1	Bad attribute value
3028	2	5	1	Requested access violates permitted actions
3029	2	5	1	Functional unit not available for requested access
3030	0	5	5	File created but not selected

3000

```
File name not found
```

Cause. The file requested on the select service could not be found. File-system error 11 was returned.

Effect. The service fails.

Recovery. The application or FTAM user should try again using a correct file name or the name of an existing, accessible file.

3002

```
Initial attributes not possible
```

Cause. The responder did not support an attribute specified on a create request.

Effect. The service fails.

Recovery. The application programmer or FTAM user should check the attribute values and determine which attribute the responder does not support, and then retry the request without specifying the unsupported attribute in the create request. If the problem persists, the Compaq problem solver can use the SCF TRACE command and the PTrace utility to troubleshoot the problem. For more information on tracing and troubleshooting, refer to the *OSI/FTAM Configuration and Management Manual.*

3004

```
Non-existent file
```

Cause. A file has ceased to exist after being selected. The VFS has received an operating system error 11 in attempting to access a previously selected file.

Effect. The service fails.

Recovery. The application or FTAM user should either retry the operation specifying a file that exists, or try again after the Compaq problem solver has replaced the file.

3005

```
File already exists
```

Cause. A create request has been sent with the override parameter set so that file creation fails if the file already exists, and the file already exists in the file system. The CREATE procedure returns an error indicating that the file already exists and cannot be created.

Effect. The service fails.

Recovery. The application or FTAM user should purge the file before attempting to create it, or change the override parameter in the create request to any valid value other than the one specifying that file creation fails if the file already exists.

3006

```
File cannot be created
```

Cause. The application or FTAM user attempted to create a directory list (NBS-9), the CREATE procedure has failed to create a file, or one or more of the contents-type parameters specified in the create request is not supported on the responder (for example, the application or FTAM user might have specified a string-significance value that is invalid for the document type).

Effect. The file is not created. The Further Details field identifies the related file-system error number.

Recovery. For an interpretation of the file-system error number, refer to the Compaq *Guardian Procedure Errors and Messages Manual*.

3007

```
File cannot be deleted
```

Cause. The application or FTAM user attempted to delete a directory list (NBS-9), or the PURGE procedure has failed.

Effect. The file is not deleted. The Further Details field identifies the related file-system error number.

Recovery. For an interpretation of the file-system error number, refer to the Compaq *Guardian Procedure Errors and Messages Manual*.

3012

```
File busy
```

Cause. An operating system file-in-use error (12) has occurred.

Effect. The service fails.

Recovery. The application or FTAM user should wait until the file is accessible and retry the operation.

3013

```
File not available
```

Cause. An unexpected operating system error has occurred, or the application or FTAM user tried to access an SQL table that is not organization relative.

Effect. The service fails.

Recovery. There is no recovery. The specified file cannot be accessed.

3016

```
Access control inconsistent
```

Cause. The application or FTAM user specified an access-control element containing more than an action list in the initial-attributes parameter of a create request. The responder uses only the action-list field of an access-control element.

Effect. The service fails, and the responder aborts the association.

Recovery. The application or FTAM user should reestablish the association and retry the create operation, specifying only an action list in the access-control element.

3018

```
Initial attributes altered
```

Cause. The application or FTAM user attempted to create a file with a future-filesize value greater than one gigabyte. The Compaq FTAM responder does not support files larger than one gigabyte.

Effect. This is an information-only diagnostic message. The file is created with a future-filesize value of one gigabyte.

Recovery. No action is necessary.

3020

```
Override selected existing file
```

Cause. The override parameter on the create request was set so that an existing file is to be selected, and the responder received a create request for a file that already exists.

Effect. This is an information-only diagnostic message. The service is completed, and the old file is selected.

Recovery. No action is necessary.

3021

```
Override deleted and recreated file with old attributes
```

Cause. The responder received a create request naming a file that already exists, with the override parameter set so that the existing file is to be deleted and a new file created using the attributes of the deleted file.

Recovery. This is an information-only diagnostic message. The service is completed, and the file is created with old attributes. The file creation date is updated.

Recovery. No action is necessary.

3022

```
Create override deleted and created file with new attributes
```

Cause. The responder received a create request for a file that already exists, with the override parameter set so that the existing file is deleted and a new file created using the attributes specified in the *i*nitial-attributes parameter.

Effect. This is an information-only diagnostic message. The service is completed. The old file is deleted and a new file is created with a new set of attributes.

Recovery. No action is necessary.

3027

```
Bad attribute value
```

Cause. An invalid value was detected in an attribute on the create or select service. This message is caused if the filename attribute cannot be decoded or is invalid for the file system.

Effect. The service fails.

Recovery. The application or FTAM user should correct the value for that attribute and retry. For possible limitations on attribute values that the Compaq FTAM responder supports, see Section 4.

3028

```
Requested access violates permitted actions
```

Cause. The requested access specified on a select request was inconsistent with the contents-type attribute specified when the file was created. The responder can return this error in two cases:

- nAny file other than an FTAM-2 file was selected for insert access. Insert access is allowed only on FTAM-2 files.
- nAn FTAM-2 file was selected for replace or extend access, or both. Replace and extend access is not allowed on FTAM-2 files.

Effect. The service fails.

Recovery. The application or FTAM user should retry with requested-access values that are valid for the contents type.

3029

```
Functional unit not available for requested access
```

Cause. The negotiated functional units were inconsistent with the requested access type specified on the select or create service.

Effect. The service fails.

Recovery. The application or FTAM user should establish a new association providing the required functional units.

3030

```
File created but not selected
```

Cause. The create request succeeded in creating a Guardian file, but the select regime has not been established because the requested access was not correct.

Effect. The file is created, but not selected. The state-result parameter of the create confirm returns a failure indication.

Recovery. The application or FTAM user should issue a select request specifying the correct requested access.

File-Management-Related Diagnostic Messages

Table A-7 displays the diagnostic error identifiers that result from either file system errors or improper management of read-attribute or change-attribute requests.

Table A-7. File-Management-Related Diagnostic Message

Identifier	Type	Observer	Source	Reason
4001	2	5	5	Attribute cannot be read
4002	2	5	5	Attribute cannot be changed
4003	2	5	5	Attribute not supported
4005	2	5	1	Bad attribute value
4006	0	5	5	Attribute partially supported

4001

```
Attribute cannot be read
```

Cause. A file-system error occurred during an attempt to read the attributes of a file.

Effect. The service fails.

Recovery. The application or FTAM user should retry the service.

4002

```
Attribute cannot be changed
```

Cause. A change-attribute request has been attempted on a directory file (NBS-9), the application or FTAM user specified an access control element containing information other than the action list (such as concurrency-access and identity) in the attributes parameter of a change-attribute request, or a file-system error occurred while the application or FTAM user attempted to change the attribute of a file.

Effect. The service fails.

Recovery. For the first cause, the application or FTAM user should not attempt to change the attributes of a directory file (NBS-9). For the second cause, the application or FTAM user should retry the change-attribute request specifying only the action list in the access control element. For the third cause, the application or FTAM user should retry the operation.

4003

```
Attribute not supported
```

Cause. Either a read-attribute request including the private attributes was issued, or an attempt was made to change an attribute that cannot be changed. Compaq FTAM does not support private attributes.

Effect. The service fails.

Recovery. No recovery is possible in the case of the read-attribute service. The Compaq FTAM responder does not support private attributes.

In the case of the change-attribute service, the application or FTAM user should restrict requests for change to the following attributes: filename, future-filesize, and access-control.

4005

```
Bad attribute value
```

Cause. The responder has received a change-attribute request with an invalid attribute value, or the file name was invalid for the Guardian 90 operating system.

Effect. The service fails.

Effect. The application or FTAM user should retry the service with a valid attribute value.

4006

```
Attribute partially supported
```

Cause. The responder received a change-attribute request that includes the storage-account attribute. The Compaq FTAM responder only partially supports this attribute.

Effect. This is an information-only diagnostic message. The request is completed.

Recovery. No action is required.

Access-Related Diagnostic Messages

Table A-8 displays the diagnostic error identifiers that can occur during the execution of file-type or processing-mode requests.

Table A-8. Access-Related Diagnostic Messages

Identifier	Type	Observer	Source	Reason
5000	2	5	1	Bad FADU (unspecific)
5001	2	5	1	Bad FADU - size error
5003	2	5	1	Bad FADU - poorly specified
5004	2	5	1	Bad FADU - bad location
5005	0	5	5	FADU does not exist
5008	2	5	5	FADU not available for writing
5011	2	5	5	FADU cannot be inserted
5012	2	5	5	FADU cannot be replaced
5015	2	5	5	Operation not available
5022	2	5	5	Processing mode unsupported
5023	2	5	1	Processing mode inconsistent
5024	2	5	5	Access context not available
5026	2	5	5	Bad write (unspecific)
5027	2	5	5	Bad read (unspecific)
5028	2	5	5	Local failure (unspecific)
5030	2	5	5	Local failure - data corrupted
5032	2	5	5	Future filesize exceeded
5036	2	5	1	Contents type inconsistent
5040	2	5	5	FADU locking not available on file

5000

```
Bad FADU (unspecific)
```

Cause. The FADU-ID parameter on a read or write request is invalid.

Effect. The responder cancels the service, and the association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response, and then reissue the read or write request with a valid FADU ID.

5001

```
Bad FADU - size error
```

Cause. The application or FTAM user tried to access a nonexistent column in an SQL table.

Effect. The responder cancels the service, and the association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response and then reissue the request, verifying that the number of data elements in the FADU sent is less than or equal to the number of columns in the table.

5003

```
Bad FADU - poorly specified
```

Cause. The responder has received an erase request for an FTAM-2 document type and the FADU-ID parameter was not begin, or in the case of an FTAM-1 or FTAM-3 document type, the FADU-ID parameter was not first. The responder can also return this diagnostic message if an invalid data type was specified for the data to be written to an SQL table, or if an attempt was made to write to an SQL table using the UA access context instead of the FA access context.

Effect. The responder cancels the service, the association is left in the file-open regime, and the file is left in an unknown state.

Recovery. The application or FTAM user should issue a cancel response, close the file, and reissue the erase request with the valid FADU ID.

5004

```
Bad FADU - bad location
```

Cause. The responder has received a read or write request with an invalid FADU-ID parameter. The responder returns this diagnostic message when the application or FTAM user attempts to access an empty file or locate a FADU corresponding to a record before the beginning or after the end of the file; or when, while reading a file, the responder receives an unexpected end-of-file message (specific to SQL tables and Enscribe relative files). The responder can also generate this diagnostic message if it receives an SQL error of -5 or if, while attempting to locate the current position in the file, it receives a file-system error.

Effect. The responder cancels the service, and the association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response, and then reissue the read or write request with a valid FADU ID.

5005

```
FADU does not exist
```

Cause. The responder received a read or erase request for an empty FTAM-2 relative file.

Effect. In the case of a read, the responder cancels the service. In the case of an erase, the responder issues a negative erase confirmation.

Recovery. This is an information-only diagnositic message. Nothing happened.

5008

```
FADU not available for writing
```

Cause. A write request has been sent to a directory file (NBS-9).

Effect. The responder cancels the service, and the association is in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response. Do not retry; you cannot write to an NBS-9 file.

5011

```
FADU cannot be inserted
```

Cause. The responder received an open request with a processing mode of insert, and the requested access on the select service did not include insert, or the processing mode of insert is not allowed for the document type selected.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should either open the file with a processing mode compatible with the services selected, or reselect the file so that it will allow FADU insertion.

5012

```
FADU cannot be replaced
```

Cause. The responder received an open request with a processing mode of replace, and the requested access on the select service did not include replace; or the processing mode of replace is not allowed for the document type selected.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should either open the file with a processing mode compatible with the services selected, or reselect the file so that it will allow FADUs to be replaced.

5015

```
Operation not available
```

Cause. Either the VFS has attempted to open a file, but the operating system OPEN procedure has failed, or a write request has been issued without the FADU operation set to insert, replace, or extend.

Effect. In the case of an open, the responder rejects the request. In the case of a write, the responder cancels the service.

Recovery. If an open failed, the application or FTAM user should check the other diagnostic messages returned to determine why the open failed. If a write failed, the application or FTAM user should send a cancel response and retry the data transfer using the correct FADU operation value.

5022

```
Processing mode unsupported
```

Cause. The responder received a write request after simplifying an FTAM-2 document type to an FTAM-1 document type in response to an open request.

Effect. The responder rejects the request and aborts the association.

Recovery. The application or FTAM user should discard the association context, reinitialize an association, and proceed with the intended operation. The responder simplifies document types only on read operations. Therefore, applications must issue only a read request after an open request that simplifies the document type.

5023

```
Processing mode inconsistent
```

Cause. The responder received an open request specifying a processing mode that is inconsistent with the requested access from the select request.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should either reissue the open request with a processing mode consistent with the requested access specified on the select, or reselect the file specifying a requested access that allows the requested processing mode.

5024

```
Access context not available
```

Cause. The responder received a read request specifying an access context that it does not support. The responder supports only flat all data units (FA), for FTAM-2 files, and unstructured all data units (UA), for FTAM-1 and FTAM-3 files.

Effect. The responder cancels the service, and the association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response and then reissue the read request with the correct FADU operation. Make sure the document type opened supports the access context. Refer to Table A-9 for valid access contexts.

Table A-9. Access Contexts by Document Typ

Document Type	Access Context
FTAM-2	FA, UA
FTAM-1, FTAM-3, and NBS-9	UA

5026

```
Bad write (unspecific)
```

Cause. A local file-system error other than an end-of-file message has occurred on the write service.

Effect. The responder cancels the service, and the association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response and then retry the application. If the error persists, the file is probably corrupt and cannot be accessed. In this case, the Compaq problem solver should perform the file recovery operations normally used at the site; then the application or FTAM user can retry the application.

5027

```
Bad read (unspecific)
```

Cause. A local file-system error other than an end-of-file message has occurred on the read service. One possible cause of this error is that one of the records in an FTAM-3 file with a string-significance value of fixed contained a string whose length was smaller than the maximum-string-length value. This could occur because the file was created outside FTAM, because it was corrupted in some way, or because the wrong file was specified.

Effect. The responder cancels the service.

Recovery. The application or FTAM user should issue a cancel response. The application or FTAM user should ensure that the correct file is specified; the file must satisfy the string-length rules described under “Maximum-String-Length Checking of Data Values” in Section 4. If the application specified the correct file, the application or FTAM user should retry the application; if the error persists, the file is probably corrupt and cannot be accessed. In this case, the Compaq problem solver should perform the

file recovery operations normally used at the site; then the application or FTAM user can retry the application.

5028

```
Local failure (unspecific)
```

Cause. A local file-system error occurred as a result of one of the following actions:

- F-ERASE error occurred while the responder was attempting to erase data from a file.
- F-LOCATE error occurred while the responder was attempting to locate a FADU.
- F-CLOSE error occurred while the responder was attempting to close a file.
- F-READ error occurred while the responder was attempting to locate the FADU to be read in an FTAM-2 file.
- F-WRITE error occurred while the responder was attempting to locate the FADU to which to write in an FTAM-2 file, or while attempting to erase data from an FTAM-1 or FTAM-3 file with a FADU operation of replace.

Effect. If the failure occurs during a read or write service, the responder cancels the service, and the file is left in an unknown state. If the failure occurs during any other action, the responder rejects the request.

Recovery. If a failure occurs during a read or write service, the application or FTAM user should issue a cancel response and retry the operation. If the failure occurs during any other action, the application or FTAM user should retry the operation.

5030

```
Local failure - data corrupted
```

Cause. The VFS attempted to open a corrupted EDIT file.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should retry the request using a different file, delete the file and create a new one, or notify the Compaq problem solver of the file condition and find out if an alternative file can be used to access the information. If an alternative file is available, the application or FTAM user should retry the request using that file.

5032

```
Future filesize exceeded
```

Cause. The VFS attempted to write data to a file and exceeded the maximum file size.

Effect. The responder issues a cancel request and cancels the data transfer.

Recovery. The application or FTAM user should send a cancel response, close the file, and use the change-attribute service to increase the value of the future-filesize attribute of the file.

5036

```
Contents type inconsistent
```

Cause. A service has been attempted without specifying a valid document type (for example, if the application or FTAM user tries to perform an FTAM-2 simplification of an SQL file); the contents type was inconsistent with the Guardian file structure, specifically the file type value; the application or FTAM user attempted to open a file specifying a maximum-string-length value outside the supported range; or the application or FTAM user specified an unsupported value of the universal-class parameter.

Effect. The responder rejects the request.

Recovery. The application or FTAM user should retry specifying a valid document type—one that is consistent with the file type of the Guardian file being accessed—and a supported universal-class value.

For information about document types and contents types, refer to Section 4. Refer to Table A-10 for FTAM contents type and Guardian file structure equivalents:

Table A-10. FTAM Contents Types and Equivalent Guardian File Structures

FTAM Contents Type	Guardian File Structure	Guardian File Type*
FTAM-1	Edit	U
FTAM-2	Relative	R
	SQL table	R
FTAM-3	Fixed-length binary	E
	Variable-length binary	E
	Unstructured	U
	Non-SQL key-sequenced	K
	Non-SQL entry-sequenced	K
NBS-9	Directory (*.*.DIRLIS)	-

*The following values are possible for file type:

U = Enscribe unstructured
R = Relative
E = Entry-sequenced
K = Key-sequenced

5040

```
FADU locking not available on file
```

Cause. The Compaq FTAM responder received a request with a FADU-lock parameter on a read or write service. The Compaq FTAM responder does not support the FADU-lock parameter.

Effect. The responder cancels the request. The association is left in a data-transfer idle state.

Recovery. The application or FTAM user should issue a cancel response, and then retry the read and write service omitting the FADU-lock parameter.

Recovery-Related Diagnostic Messages

Table A-11 displays the diagnostic error code that may be generated during recovery operations

.

Table A-11. Recovery-Related Diagnostic Messages

Identifier	Type	Observer	Source	Meaning
6010	2	5	1	Recovery mode not available

6010

```
Recovery mode not available
```

Cause. Recovery has not been set to none (0) on the open request to the responder.

Effect. The responder rejects the open request because none (0) is the only recovery value Compaq supports.

Recovery. The application or FTAM user should set recovery to none (0) and retry the open operation.

Glossary

The following glossary defines terms used both in this manual and in the other Compaq FTAM manuals. Not all terms listed here are used in this particular manual.

abstract syntax. A standardized method of describing data structures that is independent of the way they are represented in data transmission. An abstract syntax uses a set of primitive elements defined by an abstract syntax notation such as ASN.1, defines ranges of values for the primitive elements, and defines ways of combining these elements. *See also* transfer syntax *and* ASN.1.

Abstract Syntax Notation-1. See ASN.1.

access-context parameter. A parameter used for read transfers within the data-transfer regime to specify the file structure by which information in the file is accessed. Possible structures for Compaq FTAM are flat all data units (for FTAM-2 files) and unstructured all data units (for FTAM-1, FTAM-2, and FTAM-3 files). *See* UA *and* FA.

access-control attribute. A file attribute that contains the information to determine whether file access is allowed or denied. The attribute value is set when the file is created. You can alter the access-control attribute using the change-attribute action.

ACSE (Association Control Service Element). An application service element (ASE) in the Application Layer of the OSI Reference Model. The ACSE exists within an application entity and enables other ASEs to establish and release associations. It is accessible to users of OSI/AS through the APS procedures. *See also* ASE *or* Application Layer.

action-result parameter. In effect, a summary of the ISO FTAM *diagnostic* parameter. The *action-result* value success (ZFTM-VAL-ACTION-SUCCESS for the FTAM API) indicates that the requested service was performed successfully. The *action-result* value failure (ZFTM-VAL-ACTION-FAILURE for the FTAM API) indicates that the service was not performed successfully. If any one of the diagnostic messages returned indicates a failure, the value of *action-result* must be failure. *See also* state-result parameter.

activity attributes. Dynamic attributes specific to an individual FTAM association. These attributes are both created and discarded during the life of an association and may change as the status of the association changes. *See also* file attributes.

AE title. *See* application entity title.

APDU (application protocol data unit). *See* PDU.

API. *See* application program interface (API).

APLMGR (Compaq OSI/Application Manager). The Compaq subsystem that performs management functions for Compaq FTAM. The APLMGR subsystem consists of two entities: the APLMGR process and the management information base (MIB). There is only one APLMGR per FTAM subsystem.

application. A user program that uses services provided by products such as Compaq FTAM. The program accesses layers of the OSI Reference Model through the top layer

(Application Layer) to manipulate files on remote computer systems. For Compaq FTAM, applications can be written in C or TAL.

application entity. The part of an application process that interacts with its peer entity in a remote application process. In an OSI application, the application entity is the part that represents the communication functionality necessary for interoperation.

application entity title (AE title). The structured identifier that identifies an application entity to the OSI network. The AE title is passed as a parameter in the ACSE A-ASSOCIATE request and returned in the A-ASSOCIATE response. *See* application entity.

Application Layer. Layer 7 of the OSI Reference Model. This layer provides the interface between user programs (application processes) and the OSI network. Layer 7 includes the standards for services such as file transfer, electronic mail, and terminal access.

Application Manager. *See* APLMGR.

application name. The Compaq OSI/AS term for a reference name used to look up an OSI address in the local OSI/AS management information base (MIB). In Compaq FTAM terminology, this name is called the common name. *See* common name.

application program interface (API). The set of functions or procedures that permits user programs to communicate with the Compaq NonStop Kernel. For Compaq FTAM, the API consists of FTM, APS, and MFM procedures used in FTAM programming. The Compaq FTAM API also includes the data definitions provided in the ZFTMDDL file and all language-specific files derived from ZFTMDDL. *See also* APS procedures, FTM procedures, *and* MFM procedures.

application service element. *See* ASE.

APS (application, presentation, and session) procedures. A set of procedure calls, provided by Compaq as part of the OSI/AS subsystem, providing application programs with access to the services of ACSE (in the Application Layer), the Presentation Layer, and the Session Layer. The names of the APS procedures all begin with the letters APS. The APS procedures are defined in the EXTDECS0 and CEXTDECS files. The APS procedures, together with the definitions in the ZAPSDDL file, constitute the OSI/AS API. A subset of the APS procedures is accessible from, and must be used with, the FTAM API. *See also* API.

arc. A directed link between two nodes in a hierarchical file.

arc length. The number of node levels in a file hierarchy from the root node to a given node. For example, the arc length of an FTAM-2 document is always 1.

ASE (application service element). A set of functions to be performed—such as file transfer, mail service, or transaction processing—along with all the elements necessary to perform that kind of work, to support a particular application.

ASI (additional service information). An internal data format used by Compaq FTAM. ASI format is displayed in some of the USER and ASN1 trace records. The Compaq initiator and responder processes transform ASI into the transfer syntax negotiated for the association, and vice versa.

ASN.1 (Abstract Syntax Notation-1). The type and value syntax or notation language for representing semantics of protocol that is described in ISO 8824. The Basic Encoding Rules (ISO 8825) standard defines a set of encoding rules that can be applied to values of types defined using the notation specified in ISO 8824. *See also* abstract syntax.

association. A connection between Application Layer entities. *See* connection.

Association Control Service Element. *See* ACSE.

attach. An operation performed by a Compaq OSI subsystem, on behalf of an application, to wait for an incoming associate or connect indication from a remote entity.

attribute. An identifiable characteristic of an object. For example, two attributes of an FTAM file are its name and its date and time of creation. In DSM, two attributes of a process are the location of its code file and its execution priority. *See also* file attributes *and* activity attributes.

attribute group. One of the four groups of file attributes defined by ISO FTAM. They are the kernel group, which must be supported by all FTAM implementations; the security group and the storage group, which are negotiated during association establishment; and the private-use group, which is also negotiated but whose definition is outside the scope of ISO FTAM.

backup CPU. The central processing unit (CPU) number of the Compaq processor on which the backup process will run. *See* backup process.

backup opener. The backup process that has an open to an FTAM initiator or responder process. *See* backup process.

backup process. In a Compaq NonStop system, a process that is identical to the primary process and is created at the same time as the primary process. These two processes act as a NonStop process pair. The backup process takes over if the primary process fails. *See* primary process.

basic data types. First-level and second-level DDL data types, which can either stand alone as data types or be used to create higher-level DDL structures.

called address. The OSI address of the responder called by the initiator that supports an FTAM application. *Contrast with* calling address *and* responding address.

calling address. The OSI address of the initiator that calls a responder in an FTAM application. *Contrast with* called address *and* responding address.

calling user. The initiator that calls a responder in an FTAM application. *Contrast with* responding user.

CEPI (connection endpoint identifier). An internally generated identification code used to track associations. In Compaq FTAM, an identifier of a connection endpoint for a given FTAM association. Use of the CEPI for an association allows transfer of information to a remote FTAM entity.

checkpoint. On a Compaq NonStop system, a snapshot of process activity that can be used in the event of a takeover to allow a backup process to maintain fault-tolerant operation. *See* backup process.

code file. A Guardian file containing the object code that you must run to create the specified process.

collector An EMS process that accepts event messages from subsystems and logs them in the event log. See EMS. *Compare* distributor.

command file. A text file containing a series of commands that you can run by issuing the OBEY command in TACL or SCF, followed by the name of the text file.

common name. A reference name used to look up an OSI address in the local OSI/AS management information base (MIB) when establishing an association. Using common names simplifies addressing for applications and allows you to subsequently change the addresses without changing your applications. In OSI/AS terminology, the common name is called the application name.

Compaq FTAM (File Transfer, Access and Management). The Compaq implementation of the ISO FTAM standard that provides the ability to manipulate files between local and remote file stores on a network.

Compaq NonStop Kernel. The operating system, which consists of the core and system services. The operating system does not include any application program interfaces.

Compaq NonStop Tools. The utility programs that perform everyday activities, including editing, formatting, restoring, backing up, sorting, spooling, binding, compiling, and installing.

Compaq OSI/AS. *See* OSI/AS.

Compaq OSI/FTAM. *See* Compaq FTAM.

Compaq OSI/TS. *See* OSI/TS.

compatibility distributor. An EMS distributor process that filters event messages according to fixed (rather than user-specified) criteria, obtains text for these messages and writes the text to the standard operating system destinations. *See also* distributor.

conditional parameter. (1) In a protocol data unit (PDU), a parameter that is present under certain circumstances, for example, if another parameter has a given value. (2) In the Compaq FTAM API, a procedure-call parameter that must be specified under certain circumstances. *Contrast with* optional parameter *and* required parameter.

confirm primitive. A primitive issued when a service user (entity) is to be informed about its request. This is one of four types of service primitives. *See* service primitive.

confirm procedure. A procedure called to retrieve the confirm data after a confirm primitive has been received. *See* confirm primitive.

confirmed service. A service in which the initiating application sends a request, and the responding application entity (for example, an FTAM responder) returns a response that is received as a confirm primitive by the initiating application. The confirm primitive acknowledges the success or failure of the requested action. *Contrast with* unconfirmed service.

conformance. The satisfaction, by an implementation of an OSI standard, of both static and dynamic conformance requirements, consistent with the capabilities stated in the

protocol implementation conformance statement (PICS). Static conformance requirements are constraints specified in the standards or related profiles to facilitate interworking. Dynamic conformance requirements determine what observable behavior is permitted by the standards or profiles in instances of communication. The PICS is a statement, made by the supplier of an OSI implementation, describing the capabilities and options that have been implemented for a given OSI protocol. *See also* profile.

connection. A link between a service access point (SAP) on one protocol stack and a corresponding point on a different protocol stack (either in the same system or in another local or remote system). *See also* association.

connection endpoint identifier. *See* CEPI.

constraint set. A specification placing restrictions and refinements on the FTAM general file model. These restrictions and refinements define a more specific model that reflects the needs of a particular class of applications.

contents-type attribute. A file attribute that indicates either the document type of a file or its abstract syntax name and constraint-set name. The value of this attribute is set at file creation and cannot be changed by the change-attribute action. *See also* contents-type parameter.

contents-type parameter. A parameter that indicates the document type of a file and, optionally, parameter values that further define the document type. The *contents-type* must either match the document type of the file being opened or be an allowed simplification of the document type. If you are using the Compaq FTAM initiator, and you do not specify *contents-type* in a call to FTM_OPEN_REQ_ , it will default to indicate that the contents type is unknown. You can then retrieve the valid file *contents-type* by calling FTM_OPEN_CNF_ , which returns information from the confirm received from the responder. This parameter must also be specified in calls to FTM_CREATE_REQ_. Document types supported by Compaq FTAM are FTAM-1, FTAM-2, FTAM-3, and NBS-9. *See* document type.

contents-type-list parameter. A parameter used for negotiating the document types and abstract syntaxes that will be available on the association. For Compaq FTAM, the default document types requested are FTAM-1, FTAM-2, FTAM-3, and NBS-9.

D-series system. A system running any Dxx version of the Compaq NonStop Kernel, such as D10 or D20.

Data Definition Language. *See* DDL.

Data Link Layer. Layer 2 in the OSI Reference Model. This layer packages data for transmission across the network and ensures that the data arrives at the next layer without any errors.

data-transfer regime. The regime established after successfully gaining read or write access to an FTAM file. In the data-transfer regime, you can send or receive data, and you can abort the association. *See also* FTAM regime, file-selection regime, *and* file-open regime.

DDL (Data Definition Language). A Compaq language for defining data. DDL builds a dictionary from the definitions, translates the definitions into File Utility Program

(FUP) commands, and generates object-definition source code in a variety of programming languages.

default user (DEFUSER). An attribute of a Compaq virtual filestore (VFS) profile that allows access to files in the Compaq responder's VFS in cases where the initiator identity and filestore password are not provided when an association is established. The default user specifies the default Guardian user ID and password to be used.

diagnostic parameter. An optional parameter providing information that qualifies the success or explains the failure of a requested FTM procedure call. For applications using the FTAM API, this parameter primarily returns whatever diagnostic messages have been received from the remote responder or the local initiator. In addition, you can use this parameter to send diagnostic messages to a remote responder using the FTM_CANCEL_REQ_ , FTM_DATA_END_REQ_ , and FTM_U_ABORT_REQ_ procedures. *See also* ISO FTAM diagnostic messages.

Distributed Systems Management. *See* DSM.

distributor. An EMS process that distributes event messages from event logs to requesting management applications, to Compaq NonStop Kernel destinations, or to a collector. *Contrast* collector.

document type. An FTAM definition, defining the structure of and method of access to a file. Compaq FTAM supports four document types: FTAM-1, FTAM-2, FTAM-3, and NBS-9. An FTAM-1 document is an unstructured text file that cannot be broken into smaller segments by the protocol. An FTAM-2 document is a structured text file divided into FADUs, which cannot be broken down. An FTAM-3 document is an unstructured binary file. An NBS-9 document is a read-only directory as defined by the NIST FTAM Phase 2 agreements.

DSM (Distributed Systems Management). A set of tools provided by Compaq to manage NonStop systems, Expand networks, and Compaq communications products. These tools include the ViewPoint console application, the Subsystem Control Facility (SCF) for data communications subsystems, the Subsystem Programmatic Interface (SPI), the Event Management Service (EMS), the PTrace (print trace) utility, token-oriented programmatic interfaces to the management processes for various Compaq subsystems, and other products.

EMS (Event Management Service). A facility provided by Compaq for event collection, event logging, and event distribution on Compaq NonStop systems. It includes different forms of event description for interactive and programmatic interfaces, lets an operator or application select specific event-message data, and allows for flexible distribution of event messages within a system or network. The FTAM and APLMGR subsystems generate event messages that are displayed as operator messages; however, the programmatic interface to FTAM and APLMGR event messages is not available for customer use. *See also* event message.

end-of-file marker. *See* EOF.

enhanced-file-management functional unit. A functional unit that adds the modification of file attributes to the capabilities of the limited-file-management functional unit. *See* limited-file-management functional unit.

Enscribe. The Compaq database file-management software provided as part of the Guardian file system. The Enscribe software provides access to—and manipulation of—records in a database on a Compaq system. Files on a Compaq NonStop system can be either Enscribe files or NonStop SQL tables. *See also* NonStop SQL.

entry. A DSM object type representing a routing table or directory entry in the OSI manager MIB. ENTRY objects are used to register local and remote OSI addresses and locally defined application names (common names) with the OSI manager process. ENTRY objects are of four types: application (APPL), TSEL, NSAP, and SNPA.

EOF (end of file). A marker placed at the end of a file to indicate that the file contains no additional information.

error. (1) A condition that causes a command or other operation to fail. *Contrast with* warning. (2) A code that indicates the outcome of a procedure call. For the procedures in the FTAM API, this value can be either a negative error code defined by Compaq FTAM or a positive Compaq file-system error number.

error code. A Compaq code returned on an APS_STATUS_ procedure call that indicates the current error condition, if any, for the CEPI specified in the APS_STATUS_ call. If a procedure-call error is indicated, you can call APS_STATUS_ to determine what occurred. APS_STATUS_ returns *error-code* and *error-subcode* values that provide more detail about the nature of the problem. *See* error subcode.

error identifier. An ISO-defined code included in a diagnostic message that identifies a diagnostic error.

error observer. An ISO-defined code included in a diagnostic message that identifies the entity that detected the diagnostic error.

error source. An ISO-defined code included in a diagnostic message to identify the presumed entity that caused the reported error.

error subcode. A Compaq subcode qualifying *error-code* returned on an APS_STATUS_ procedure call. If a procedure call error is indicated, call APS_STATUS_ to determine what occurred. APS_STATUS_ returns *error-code* and *error-subcode* values that provide more detail about the nature of the problem. *See* error code.

error type. An ISO-defined code included in a diagnostic message that indicates the diagnostic error type: informative message, permanent error, or transient error. *See* informative message, permanent error, *and* transient error.

event. (1) In Compaq OSI terms, an indication or confirm primitive that an application using the FTAM or OSI/AS API retrieves by calling the APS_EVENT_RECEIVE_ procedure. *See also* indication primitive *or* confirm primitive. (2) In DSM terms, a significant change in some condition in the system or network. Events can be operational errors, notifications of limits exceeded, requests for action needed, and so on. *See also* EMS *and* event message.

Event Management Service. *See* EMS.

event message. On Compaq NonStop systems, a message triggered when a subsystem or system component using the Event Management Service (EMS) detects the

occurrence of a condition that might affect its operation. Event messages are collected centrally and distributed to files, processes, and terminals that are programmed to receive them. They are displayed in text form as operator messages.

execution priority. A numeric-valued attribute of a Compaq process that determines whether the Compaq NonStop Kernel will preempt execution of the process in favor of other processes running in the same CPU. The NonStop Kernel always executes the highest-priority process that is ready to run. In SCF, the execution priority of an FTAM initiator or responder process is determined using the PRIORITY attribute of the PROCESS object.

Expand network. A network of up to 255 Compaq NonStop systems, interconnected using the Expand network operating software. Compaq NonStop systems on an Expand network are referred to as nodes.

extend (write action). To append the data being written to the end of a file.

external process name. *See* Guardian process name.

FA (flat all data units). An access context for which data is transferred as a sequence of node-descriptor data elements and file-contents data elements. The transfer begins with the node-descriptor data elements, which mark the beginning of data for each node in the structure. This methodology preserves the structural semantics of the file. In Compaq FTAM, the only document type that uses FA is FTAM-2. *See* access context; *contrast with* UA.

FADU (file-access data unit). A unit of the file-access structure on which the transfer, delete, extend, replace, and insert actions can be performed. A FADU contains zero or more data units.

FADU-locking functional unit. A functional unit that allows concurrency control locks to be invoked on FADUs.

fault tolerance. The ability of a computer system to continue performing its designated functions when any part of the system fails.

file-access data unit. *See* FADU.

file-access functional unit. A functional unit that provides for access to an individual FADU in the file-access structure and allows the FADU to be manipulated within the file-access structure.

file-access service class. The service class that allows access to remote files, and includes data manipulation and file management capabilities.

file-attribute group. *See* attribute group.

file attributes. Information about a file such as file name, storage account, and date and time of (file) creation. File attributes are present from one file access to another, although the actual values of a file attribute may change. *See also* activity attributes.

file-availability attribute. An attribute that indicates whether a file is available for immediate or deferred access. For example, a file on a nondemountable device might be classified as having immediate availability, whereas a file on a demountable device might be classified as having deferred availability, because a significant delay could be

encountered in accessing the file on the demountable device. The attribute value is set when a file is created.

file-management service class. A service class that permits control of the virtual filestore through a series of independent confirmed service exchanges, but does not include file-transfer mechanisms. The file-management service class permits the ability to read and change file attributes, and create and delete files.

file number. A unique number generated by the Compaq NonStop Kernel to be used in file-system calls. The number is assigned to a file when an application accesses that file, and it is discarded when the application is finished with the file. You can display a file number by issuing the SCF LISTOPENS command to the appropriate object.

file-open regime. The regime entered when you successfully open an FTAM file. In this regime, you can locate a part of the file to be worked on, erase the file, or request access to read or write information in the file. You can also close the file, and you can abort the association. *See also* data-transfer regime, file-selection regime, *and* FTAM regime.

file protocol machine. The protocol state machine for FTAM. *See* protocol state machine.

file-selection regime. The regime entered after you successfully select or create an FTAM file. In this regime you can read file attributes, change the attributes, or open the file. You can also deselect the file or delete the file, and you can abort the association. *See also* data-transfer regime, file-open regime, *and* FTAM regime.

filestore-password parameter. The password used by an FTAM responder to authenticate the initiator identity. For Compaq FTAM applications, if this parameter is not supplied by the application, no password is sent to the remote responder.

file-system request. A request to the file system by or on behalf of a process. Several different file-system requests are monitored for a process. You can view the number of these requests that have occurred by issuing the SCF STATS PROCESS command.

file storage system. An organized collection of files, including attributes and names, residing on a computer system. On Compaq systems, the file storage system used is the Guardian file system.

File Transfer, Access and Management. *See* FTAM.

file-transfer-and-management service class. A service class that combines the services of the file-transfer and file-management service classes. *See* file-transfer service class *and* file-management service class.

file-transfer service class. The service class that supports the movement of files or partial files between independent computer systems on the network. The protocol for the file-transfer class uses grouped operations that simplify data transfer.

File Utility Program. *See* FUP.

filter. A Compaq file containing a list of criteria against which incoming EMS event messages can be compared so as to pass a given message (if it met all criteria) or not pass it (if it failed one or more criteria). *See* event message.

first-level data types. The lowest-level DDL structures, which serve as building blocks on which DDL parameter structures are based.

format effectors. A class of control characters mainly intended for layout and positioning of information on character-imaging devices, such as printers and video display terminals.

FTAM (File Transfer, Access and Management). A set of Application Layer services and protocols used for manipulating files across an OSI network, as defined by the ISO-8571 specification.

FTAM API. *See* API.

FTAM initiator errors. Locally generated errors returned when the return value on a Compaq FTAM procedure call (shown in the Compaq FTAM manuals as *status* or *error*, depending on the procedure) indicates an error. The value of *status* or *error* indicates what occurred and how to proceed.

FTAM regime. The regime entered when you successfully establish an FTAM association. In the FTAM regime, you can attempt to select or create a file, and you can terminate or abort an association. *See also* data-transfer regime, file-selection regime, *and* file-open regime.

FTAM-1 file. An unstructured text file that can be accessed only as a single data unit. *See also* document types.

FTAM-2 file. A sequential text file that can be accessed either as a single data unit or as multiple data units. *See also* document types.

FTAM-3 file. An unstructured binary file that can be accessed only as a single data unit. *See also* document types.

FTC profile. A Compaq FTAM profile used as a template to configure an alternate event collector. *See also* VFS profile.

FTM procedures. The set of procedure calls whose names begin with “FTM”, provided with Compaq FTAM to support the FTAM protocol. The FTM procedures are defined in the EXTDECS0 and CEXTDECS files. The FTAM API consists of the FTM procedures plus the MFM procedures, a subset of the APS procedures, and associated definition files. *See also* API.

functional unit. In OSI terms, a collection of service primitives needed to provide one of the major optional styles of working, such as file access or enhanced file management. Functional units are negotiated at association establishment. Functional units determine which sets of FTAM services are available for an association, depending on which service class is negotiated.

FUP (File Utility Program). A Compaq utility program that can be used to perform many functions on disk files and peripheral devices such as tape drives. For example, you can use FUP to create and purge files, duplicate and display files, alter file characteristics such as security attributes, and load data into files.

future-filesize attribute. A file attribute that specifies the size limit (in octets) for modification or extension of the file. The future-filesize attribute is related to the

Compaq max-extents attribute: modifying the future-filesize attribute changes the max-extents attribute, and vice versa.

GeneralString. The character-string type of strings containing any of the characters for all G sets and all C sets (as defined by ISO 2022), the space character, and the delete character. These strings contain format effectors.

GraphicString. The character-string type of strings containing any of the characters for all G sets (as defined by ISO 2022) and the space character. These strings do not contain format effectors.

grouped procedure. An FTM procedure that allows an application to perform several file operations as a grouped service. The grouped procedure FTM_FILE_OPEN_REQ_ allows you to create, select, and open an FTAM file as a grouped service. The grouped procedure FTM_FILE_CLOSE_REQ_ allows you to close and either deselect or delete an FTAM file as a grouped service. *See* grouped service.

grouped service. A sequence of confirmed services that are requested in one FTAM event, and for which the responses are received as one event. The request primitives for these services are bracketed with the F-BEGIN-GROUP and F-END-GROUP request primitives. *See also* grouping control.

grouping control. A mode of operation that allows your application to perform a sequence of confirmed services in one FTAM event. The request primitives for these services are bracketed with the F-BEGIN-GROUP and F-END-GROUP request primitives. The grouped request primitives are concatenated and sent in a single request PDU. The responder analyzes and retains its response to each of these requests until the group is complete or until a state failure occurs. The responder then returns its responses as a group.

grouping functional unit. A functional unit that provides for the combination of several independent primitives in order to establish several regimes in one exchange.

Guardian . The original application program interface (API) to the Compaq NonStop Kernel.

Guardian environment. The Guardian API and the Compaq NonStop tools. Referred to as “personality” in marketing literature.

Guardian process name. The external name by which the Compaq NonStop Kernel identifies a process. This name is assigned when a process is created using the NAME attribute. To operate on a Compaq Expand network, this name must be a maximum of five ASCII characters, including the initial dollar sign ($).

hierarchical file model. A file structure with the following characteristics:

- The file-access structure is an ordered tree.
- Each node within the structure is assigned zero or one data unit.
- Each node provides access to its subtree.
- A node can, optionally, be named.

- There are no restrictions on the number of levels, on the arc lengths, or on the number of arcs originating from each node.

The access unit, or subtree, of a node in this model is called a file-access data unit (FADU). FTAM-2 files have a two-level hierarchy of one root node and many second-level nodes. FTAM-1 and FTAM-3 files have only a single root FADU. *See* FADU *and* root FADU.

IA5String. The character-string type of strings containing any of the 32 control characters, 94 displayable characters, the space character, and the delete character, as defined by CCITT Recommendation T.50. These strings contain format effectors.

indication primitive. A primitive issued when a service user (entity) is to be informed about an event. This is one of four types of service primitives. *See* service primitive.

indication procedure. A procedure called to retrieve the indication data after an indication primitive has been received. *See* indication primitive.

indirect-process-name. A variable that represents the name of a Compaq initiator or responder process as it is known to APLMGR. It consists of three parts: $*appl-mgr-name*, #*proc-type*, and *internal-name*, which are separated by periods (.). An SCF command that uses this form of process name is sent to the APLMGR process, which looks up the specified process in its MIB and then routes the command to the process. *Contrast with* $process-name.

informative message. An ISO-defined type of diagnostic error code that does not require recovery and does not affect the current state of the file service. An informative message provides information to qualify a successful action. *See also* error type, permanent error, *and* transient error.

initiator. The file-service user that requests the establishment of the FTAM regime. In Compaq FTAM, the initiator is a process that allows FTAM applications on a Compaq NonStop system to access FTAM protocol and to request services of a responder on a remote computer system. It operates by establishing an association with the remote responder over the OSI network. The initiator then sends and receives FTAM protocol messages to and from the remote responder. The FTAM application programmatic interface (API) is the application program's interface to the initiator process. *See also* FTAM API; *contrast with* responder.

initiator-identity parameter. A parameter that identifies the calling user on an FTAM association. For Compaq FTAM applications, if this parameter is not sent by the application, no initiator identity is supplied to the remote responder. *See* calling user.

Inspect. The Compaq interactive symbolic debugger, which enables you to isolate errors in programs running on Compaq NonStop systems. Inspect features include interactive control of program execution with breakpoints, distributed debugging across a network, concurrent debugging of all parts of an application, saving and examining process states, and local system and personal customization.

interactive interface. A set of rules by which a human operator is allowed to perform functions at a terminal in response to system prompts. *Contrast with* programmatic interface.

intermediate state. *See* state transition.

internal process name. The name by which APLMGR recognizes a Compaq initiator or responder process. This name is assigned when the process is created and can be a maximum of eight ASCII characters.

International Organization for Standardization. *See* ISO.

International Standard. *See* IS.

interoperability. The ability of an FTAM implementation to work with other FTAM implementations to deliver FTAM services.

IS (International Standard). A final specification standard issued by ISO.

ISO (International Organization for Standardization). A worldwide federation of national standards bodies established to promote the development of standards to facilitate the international exchange of goods and services, and to develop mutual cooperation in areas of intellectual, scientific, technological, and economic activity.

ISO FTAM. Generic FTAM as specified in the ISO 8571 standard.

ISO FTAM diagnostic messages. Diagnostic messages typically returned from the remote responder, although in certain cases they may be returned locally. ISO diagnostic messages are defined in the ISO 8571 standard for FTAM, and apply generically to any FTAM application. Diagnostic messages can be retrieved by some indication and confirm procedures. In addition, programs using the FTAM API can send diagnostic messages to the remote responder using the FTM_CANCEL_REQ_ , FTM_DATA_END_REQ_ , and FTM_U_ABORT_REQ_ procedures. *See also* diagnostic parameter.

ISO Reference Model for Open Systems Interconnection. *See* OSI Reference Model.

ISO646String. *See* VisibleString.

kernel functional unit. A functional unit that is required of all service classes used in the establishment and release of the FTAM and file-selection regimes. This is not to be confused with the Compaq NonStop Kernel, which is the operating system.

kernel group. File attributes that must be supported by all FTAM implementations. You do not negotiate attributes in the kernel group. This is not to be confused with the Compaq NonStop Kernel, which is the operating system.

layer. There are seven layers in the OSI Reference Model. *See* Application Layer, Presentation Layer, Session Layer, Transport Layer, Network Layer, Data Link Layer, *and* Physical Layer.

leaf. A node in a hierarchical file structure that has no child nodes: that is, no nodes that terminate outbound arcs of the node in question.

limited-file-management functional unit. The functional unit that supports the creation and deletion of files and the reading of file attributes.

local application. An FTAM application that runs on a Compaq NonStop system and uses the FTAM API.

Management Information Base. *See* MIB.

management interface. An interface available to the system manager for use in configuring, monitoring, and controlling subsystems and relationships between subsystems.

Manager process. A Compaq subsystem process with which the Subsystem Control Point (SCP) management process communicates to control a particular subsystem. The APLMGR process is the manager process for Compaq FTAM; the OSI manager process is the manager process for OSI/AS; and the TSP process is the manager process for OSI/TS.

maximum-string-length parameter. An optional parameter of *contents-type* that indicates the maximum number of octets (excluding escape-sequence octets) that can be transmitted in a character string during the data-transfer regime. *See also* contents-type parameter.

MFM (module file management) procedures. A set of procedure calls, used with Compaq FTAM and Compaq OSI/AS, that allow you to complete I/O operations performed in nowait mode and to cancel a nowait operation. The names of the MFM procedures begin with the letters MFM. The MFM procedures are defined in the EXTDECS0 and CEXTDECS files. These procedures are part of the FTAM API. *See also* API.

MIB (Management Information Base). (1) A database used by the OSI manager process to store and retrieve configuration information and information about applications. (2) A database used by APLMGR to store and retrieve FTAM configuration information.

module file management procedures. *See* MFM procedures.

named values. DDL variables that specify values or sets of values that can be assigned to FTAM procedure parameters or parameter fields.

National Institute of Science and Technology. *See* NIST.

NBS (National Bureau of Standards). Former name of the National Institute of Science and Technology (NIST). *See* NIST.

NBS-9. A file that is a read-only directory as defined by the NIST FTAM Phase 2 agreements. *See also* document types.

negotiation. The act of defining parameter values to be used on an FTAM association. For example, in the initialize request (the FTM_INITIALIZE_REQ_ procedure call when using the FTAM API), you propose a list of the attribute groups (storage and/or security) that you want to be available for the association, using the *attrib-groups* parameter. The responder inspects the attributes you propose and may reduce the list to what it can support; it cannot add to the list you propose. When attribute groups have been negotiated, you can use the attributes from those groups along with the associated protocol.

Network Layer. Layer 3 in the OSI Reference Model. This layer routes data by establishing, maintaining, and terminating communication between systems. It sets up a path, both physical and logical, between communicating systems; routes messages through intervening systems to their destination; and controls the flow of messages between systems.

Network service access point. *See* NSAP.

network service provider. *See* NSP.

NIST (National Institute of Science and Technology). A U.S. government institution, formerly known as the National Bureau of Standards (NBS), that sets standards and promotes their acceptance.

node. (1) The basic building block of the FTAM hierarchical file structure. (2) A Compaq NonStop system that is part of an Expand network.

node descriptor. The part of an FTAM-2 FADU that contains information identifying the node within the FTAM hierarchical file structure.

node name. The part of a node descriptor that names the node. *See* node descriptor.

nonsensitive command. An SCF command that can be issued by any user or program allowed access to the target subsystem—that is, a command on which the subsystem imposes no further security restrictions. For Compaq data communications subsystems, the nonsensitive commands are all those that cannot change the state or configuration of objects (usually information commands). *Contrast with* sensitive command.

NonStop process pair. *See* process pair.

NonStop SQL (Structured Query Language). The Compaq product that provides configuration and management of relational databases that conform to the SQL (structured query language) standard. *See* SQL.

nowait mode. In Guardian file-system operations and in some APS operations, the mode in which the called procedure initiates an I/O operation but does not wait for it to complete before returning control to the caller. The application calls a separate procedure (MFM_AWAITIOX_) to wait for the completion of the operation. *Contrast with* wait mode.

NSAP (network service access point). The logical point at which Network Layer services are provided by the Network Layer entity to the Transport Layer entity.

NSP (network service provider) process. A process in the Compaq OSI implementation that performs service and protocol functions for the Network Layer and, for LANs, some functions of the Data Link Layer. NSP processes are provided by the underlying X25AM and TLAM subsystems. *See also* TSP process *and* TAPS process.

null object type. A Compaq term used to represent the absence of an object type in an SCF command. If a command supports the *null* object type, you can issue it without specifying an object type. For Compaq FTAM, the NAMES and VERSION commands support the *null* object type. The NAMES *null* command refers to a collection of object types; for the VERSION *null* command, the object type is irrelevant.

object. (1) A well-defined piece of information, definition, or specification that requires a name. *Also called* information object. (2) In general Compaq terms, one or more of the devices, lines, processes, and files in a Compaq subsystem: any entity subject to independent reference or control by one or more subsystems. An object typically has a name and a type known to the controlling subsystem.

object identifier. A value, distinguishable from all other such values, that is associated with an ISO information object. A standard representation of an object identifier is a set of numbers representing a directed path through a standards-based tree hierarchy, often shown as a sequence of two or more values enclosed in braces ({}). Examples of objects represented by object identifiers are document type names, constraint sets, abstract syntaxes, transfer syntaxes, and AE titles.

object state. *See* state.

object state transition. *See* state transition.

octet. A byte of data; eight bits.

OctetString. The string type consisting of a string of octets. *See* octet.

open. An established line of communication between two processes. You can display the number of opens a process has by issuing the SCF STATUS PROCESS command.

open network. A communications network that is able to communicate between systems using standardized procedures and functions.

Open Systems Interconnection. *See* OSI.

operator message. A message, describing a significant event on a Compaq NonStop system, that is intended to be seen by an operator. An operator message is the displayed-text form of an EMS event message. *See* event message.

optional parameter. (1) In a protocol data unit (PDU), a parameter that is sometimes but not always present. (2) In the Compaq FTAM API, a procedure-call parameter that can be included in a given procedure call or command, but is not required for use with the procedure or command. *Contrast with* conditional parameter *and* required parameter.

original-error-info parameter. A parameter in the APS_STATUS_ procedure call that provides a code identifying the first error detected in Compaq FTAM or an underlying OSI layer. Using the service ID, which indicates the source of the error, and the value returned by *original-error-info*, you can refer to Compaq manuals for further information about the problem. *See also* service ID.

OSI (Open Systems Interconnection). A set of standards used for the interconnection of heterogeneous computer systems designed for universal connectivity.

OSI address. The address of an object on an OSI network. An OSI address consists of four components: the transport selector (TSEL), session selector (SSEL), presentation selector (PSEL), and network service access point (NSAP).

OSI/AS (Application Services). The Compaq implementation of the Session Layer, the Presentation Layer, and part (ACSE) of the Application Layer of the OSI Reference Model. The OSI/AS subsystem manages the communication of messages between a local Compaq system and a remote system on a network. This subsystem manages the lower-layer services provided by Compaq OSI/TS, X25AM, and TLAM.

OSI manager process. A process in the OSI/AS subsystem that performs subsystem management functions. There is one OSI manager process per OSI/AS subsystem.

OSI Reference Model. A communications architecture, adopted by the ISO in 1984, that includes seven layers that define the functions involved in communications between two systems, the services required to perform these functions, and the protocols associated with these services. *See also* layer.

OSI subsystems. The Compaq subsystems that support the various layers and application service elements of the OSI Reference Model, including the FTAM subsystem, APLMGR, OSI/AS, OSI/TS, and TLAM or X25AM.

OSI/TS (Transport Services). The Compaq subsystem that manages the communication of messages from the Transport Layer on a local Compaq system to the Transport Layer on a remote system in an OSI network.

owner ID. The identity (Guardian user ID) of the owner of a process on a Compaq NonStop system.

parallel associations. Multiple associations running concurrently within a Compaq FTAM process.

parameter structures. DDL structures that define some of the reference parameters for the FTM, APS, and MFM procedures.

partially supported file attribute. A virtual filestore (VFS) file attribute, in a supported storage or security attribute group, for which any reference by the FTAM responder yields the result that no value is available, and any attempt to change the attribute fails. In summary, the VFS recognizes the attribute name but provides no value for it. *Contrast with* supported file attribute.

PDU (protocol data unit). The encoded message transferred across the OSI network between peer entities—for example, between an FTAM initiator and responder. Data, such as a block of information being transferred or a protocol primitive, is encoded into a PDU for transfer across the network. The PDU is decoded when it arrives at its destination. Types of PDUs include the following:

- APDU (application PDU): information exchanged between Application Layer entities—this includes ACSE and presentation PDUs created to support the FTAM protocol (FTAM PDUs, or FPDUs)
- PPDU (presentation PDU): information exchanged between Presentation Layer entities
- SPDU (session PDU): information exchanged between Session Layer entities
- TPDU (transport PDU): information exchanged between Transport Layer entities

permanent error. An ISO-defined type of diagnostic error that occurs every time the sequence of events that caused the error is repeated, and implies the failure of at least the present operation being performed. *See also* error type, informative message, *and* transient error.

permitted-actions attribute. A file attribute that can be returned in an F-READ-ATTRIB indication or confirm or set in an F-CREATE request. It specifies the actions that can be performed on the file or the mode of access to FADUs in the file. During the F-CREATE service, the initiator proposes a set of values. The responder can either accept the proposed values or change them to any set of values it can handle: for

example, a default set of permitted actions that is always used for a specific document type regardless of what is proposed. The responder implements the set of permitted actions in some way that maps them onto the underlying real system.

Physical Layer. Layer 1 in the OSI Reference Model. This layer establishes the actual physical connection between the network and the computer equipment. Protocols at the Physical Layer include rules for the transmission of bits across the physical medium and rules for connectors and wiring.

PID (process identifier). The combination of the central processing unit (CPU) number and the process identification number (PIN) for a process running on the Compaq NonStop Kernel.

port address. For X25AM lines, the logical port number used with the X.25 network; for TLAM, the address used to communicate with a LAN controller.

PPDU (presentation PDU). *See* PDU.

presentation address. An unambiguous name used to identify a set of presentation service access points (PSAPs) that are all located at a boundary between a Presentation Layer implementation and an Application Layer implementation in the same open system.

presentation context. The combination of an abstract syntax and a transfer syntax on a Presentation Layer connection. In Compaq FTAM, you have programmatic control over the choice of presentation context related to document types, but not over the required abstract syntaxes associated with the protocol control information (PCI) for FTAM, ACSE, and the Presentation Layer.

Presentation Layer. Layer 6 in the OSI Reference Model. This layer provides a means to resolve the differences of varying data formats between systems of different vendors. It transfers data in a system-independent manner, performing appropriate conversions at each system as necessary.

presentation selector. *See* PSEL.

presentation service access point. *See* PSAP.

primary process. The currently operating process of a process pair on a Compaq NonStop system. *See* backup process.

primitive. An abstract, implementation-dependent representation of an interaction between a user of OSI services and a service provider. Examples of FTAM primitives are an F-OPEN request, an F-P-ABORT indication, an F-CREATE response, and an F-READ-ATTRIB confirm.

PrintableString. The character-string type of strings containing only printable characters and the space character, as defined in ISO 8824. These strings do not contain format effectors.

printing distributor. An EMS process that obtains formatted text for selected event messages and distributes it to a file, a printer, or another display device.

priority. *See* execution priority.

private group. A free-standing group of FTAM attributes that are outside the scope of OSI standardization.

process. A running entity, managed by the Compaq NonStop Kernel, that is created by taking a program from a file on a disk and running it in a processor.

process identification number (PIN). An unsigned integer that identifies a process in a processor module. Internally, a PIN is used as an index into the process control block (PCB) table. PIN numbers from 0 through 254 are low PINs and are supported on both C-series and D-series systems. PIN numbers from 256 through 65535 are high PINs and are supported only on D-series systems. PIN 255 is in neither subrange; it is called a synthetic process ID and allows an unconverted D-series system server process to communicate with a high-PIN requester process.

process pair. A primary process and its backup process, created as a pair to provide fault tolerance on a Compaq NonStop system. The backup process takes over if the primary process fails.

profile. (1) A complete set of self-consistent parameters specifying which options in one or more OSI standards will be supported by a group of implementations for a particular purpose. For example, the U.S. Government Open Systems Interconnection Profile (GOSIP) is a profile to which implementations must conform to be eligible for certain government contracts. (2) For Compaq FTAM, a type of object defining a template that contains configuration parameters for Compaq FTAM responder processes. When a profile is specified for a process, the configuration parameters in the profile take precedence over any corresponding parameters specified for the process. (3) Also for Compaq FTAM, a type of object defining a template that contains configuration parameters for an alternate collector for event messages. (4) For Compaq OSI/AS, a type of object defining a template that contains configuration parameters for OSI/AS dynamic subdevices. When a profile is specified for a connection, the configuration parameters in the profile take precedence over any corresponding parameters specified for the service as a whole.

profile type. A particular type of Compaq FTAM or OSI/AS profile. The only valid profile type for Compaq FTAM is the virtual filestore (VFS) profile.

programmatic interface. A set of procedures and accompanying definitions that enable programs to request services or operations. *Contrast with* interactive interface.

protocol. The set of rules governing the format and meaning of the frames, packets, or messages exchanged by the peer entities within an OSI layer. *See also* service.

protocol data unit. *See* PDU.

protocol state machine. The part of a data communications process, such as an FTAM initiator or responder process, that acts upon occurrences according to the current state of the protocol.

provider abort. An association abort initiated by the service provider (for example, FTAM). An abort leaves the status of any interrupted operations undefined. *Contrast with* user abort.

PSAP (presentation service access point). The point at which a Presentation Layer implementation provides presentation services to an Application Layer implementation.

The PSAP is highly system-dependent and generally refers to the way interlayer communication is accomplished. *See also* SAP.

PSAP address. A presentation address that is used to identify a single PSAP.

PSEL (presentation selector). A logical address in the Presentation Layer through which presentation services are made available to Application Layer implementations. On a Compaq system, the PSEL is a number that uniquely links a TAPS process with a process that implements Application Layer services—for example, an FTAM initiator or responder.

PTrace (print trace). A Compaq utility that you can use to select, format, and display unstructured trace data generated when you issue the SCF TRACE command.

read functional unit. A functional unit that allows the following activities on an association:

- Establishing the file-open regime
- Transferring data from the responder to the initiator
- Releasing the file-open regime

receiver. The entity that receives a communication from a remote sender. *See* sender.

recovery functional unit. An ISO FTAM functional unit that allows the initiator process to recreate a previously destroyed regime.

regime. A protocol state that reflects the programming status in an FTAM program sequence. Compaq FTAM and ISO FTAM have four regimes: FTAM regime, file-selection regime, file-open regime, and data-transfer regime.

register request. (1) For Compaq FTAM, a request made by the FTAM API to the APLMGR process, on behalf of an application, to establish an FTAM association. Processing an FTAM register request includes selecting an available initiator process to service the association. (2) For Compaq OSI/AS, a request made by the API to the OSI manager process, on behalf of an application, either to establish an association (or connection) or to wait for an incoming association (or connection).

relaxation. The process of deriving one document from another by making the parameters describing it less restrictive. In particular, the legal modification of values for the maximum-string-length, string-significance, or universal-class parameters for a specific FTAM document type. String-length relaxation allows a document of with a given maximum-string-length value to be opened and read using a larger maximum-string-length value or no maximum-string-length value (unbounded string). Character-set relaxation allows a document of a given universal-class number to be opened and read using a different universal-class number as long as the new universal-class number permits all characters from the original universal-class number.

request primitive. A primitive issued when a service user (entity) wants the service to do some work. This is one of four types of service primitives. *See* service primitive.

request procedure. A procedure called to cause the initiating process to send a request primitive to a responding process. *See* request primitive.

required parameter. (1) In a protocol data unit (PDU), a parameter that is always present. (2) In a Compaq programmatic or interactive interface, a parameter to a procedure (for example, a procedure in the FTAM API) or to an interactive command (such as an SCF command) that must be specified when the procedure is called or the command is issued. *Contrast with* conditional parameter *and* optional parameter.

reset time. In SCF, the date and time that the statistical counters for an object were last reset. The STATS command for the object displays the reset time.

responder. The file-service user that accepts an initiator's request to establish an FTAM regime. In Compaq FTAM, the responder is a process that services FTAM requests initiated from remote systems on an OSI network. The Compaq responder acts as an FTAM file server, mapping FTAM requests into Guardian file operations and providing a translation between Guardian file structures and FTAM file structures. The Compaq responder has no programmatic interface. *Contrast with* initiator.

responding address. The OSI address of the responder that responds to an association request from an initiator in an FTAM application. *Contrast with* called address *and* calling address.

responding user. The responder that responds to an association request from an initiator in an FTAM application. *Contrast with* called address *and* calling address.

response primitive. A primitive issued when a service user (entity) wants to respond to an event (for confirmed services only). This is one of four types of service primitives. *See* service primitive.

response procedure. A procedure called by your application to send response primitives to indications from the FTAM responder. *See* response primitive.

restart-data-transfer functional unit. An ISO FTAM functional unit that allows the transfer of data to be interrupted and immediately restarted in a current transfer.

reverse traversal. Traversal through the nodes of an FTAM file in reverse order (last to first).

root FADU. The first-level FADU in an FTAM file. In the case of FTAM-1 and FTAM-3 files, the complete file is one FADU and so can be considered the root FADU. FTAM-2 files consist of two levels of FADUs in a hierarchical structure. The root FADU provides access to the complete file. *See* FADU.

root node. The first-level node in a hierarchical file. *See* root FADU.

Safeguard. The Compaq system-software security package that implements three security features: user authentication, object-access authorization, and auditing.

sample time. In SCF, the date and time that the currently displayed statistics for an object were gathered. The sample time is displayed by the STATS command along with the statistics.

SAP (service access point). The point at which an implementation of a given OSI layer provides its services to an implementation of the layer above it. The SAP is highly system-dependent and generally refers to the way interlayer communication is accomplished.

SCF (Subsystem Control Facility). A utility that provides a common, interactive management interface for configuring, controlling, and collecting information from Compaq data communications products.

SCP (Subsystem Control Point). The process used to provide the focal point for all Compaq data communications subsystems. There can be several instances of this process. Applications using SPI send all commands for data communications subsystems to an instance of this process, which in turn sends the commands on to the manager processes of the target subsystems. SCP also processes a few commands itself. It provides security features, version compatibility, support for tracing, and support for applications implemented as NonStop process pairs.

second-level data types. DDL data types made up of one or more first-level data types. *See* first-level data types.

security group. File attributes that pertain to security and access control. These attributes are negotiated at association establishment. The security group attributes are access control and legal qualifications.

sender. The entity that initiates and sends a communication to a remote receiver. *See* receiver.

sensitive command. An SCF command that can be issued only by a restricted set of Guardian users, such as process owners and super-group users. For Compaq data communications subsystems, the sensitive commands are those that can change the state or configuration of objects, start or stop tracing, or change the values of statistics counters. *Contrast with* nonsensitive command.

sequential flat file. An unstructured file whose data must be accessed sequentially.

service. The functions and features provided by a given layer to the layer above it in the OSI Reference Model. Also, the functions and features provided to the application programmer by the Compaq FTAM process. *See also* protocol.

service class. A set of functional units negotiated at association establishment. ISO FTAM specifies five levels of service classes.

service ID. A value identifying the Compaq OSI service that is the source of an error condition being reported. The APS_STATUS_ procedure returns service ID values in the *service-id* parameter and within the structure returned in the *original-error-info* parameter. *See also* original-error-info parameter.

service primitive. An abstract, implementation-independent interaction between a service user and a service provider. Service primitives describe the sequences of events between adjacent layers that occur through the service access point (SAP). There are four types of service primitives. *See also* request primitive, indication primitive, response primitive, *and* confirm primitive.

service provider. An entity that provides services for a higher-layer entity. For example, the FTAM initiator is a service provider, providing FTAM services to an FTAM application program. *Contrast* service user.

service user. An entity that uses services provided to it by a lower-layer entity. For example, the FTAM initiator is a service user of ACSE and presentation services provided by OSI/AS. *Contrast* service provider.

session address. *See* SSAP.

Session Layer. Layer 5 in the OSI Reference Model. This layer allows the setup and termination of communication sessions between systems on the network.

session selector. *See* SSEL.

session service access point. *See* SSAP.

simplification. The process of deriving one document from another document of a different type by discarding structural information. In particular, the act of reading a file of a specific FTAM document type as a less structured, or simpler, FTAM document type.

SPDU (session protocol data unit). *See* PDU.

SPI (Subsystem Programmatic Interface). A set of procedures and associated definition files used on Compaq NonStop systems to define common message-based interfaces for communication between requesters and servers—for example, in a management application. The SPI interface to Compaq FTAM is not available for customer use.

SQL (structured query language). A fourth-generation-language standard that provides a means to access and associate data in a relational database.

SSAP (session service access point). A network-unique address in the Session Layer through which connections are established and maintained; *also called* session address.

SSEL (session selector). A logical address in the Session Layer through which session services are made available.

state. (1) The condition at a particular point in the OSI protocol. *See also* protocol state machine. (2) In DSM, the current condition of an object that indicates its readiness to do work. States for PROCESS objects include STARTED, STOPPED, SUSPENDED, and UNKNOWN. The only state for SU objects is STARTED; the only state for SUBSYS objects is DEFINED. *See also* state transition; *also called* summary state.

state machine. *See* protocol state machine.

state-result parameter. A parameter, returned in indications and confirms for primitives that establish a regime, that indicates whether or not the remote responder has established the requested regime. The valid values are success (ZFTM-VAL-STATE-SUCCESS in the FTAM API) and failure (ZFTM-VAL-STATE-FAILURE in the FTAM API). Note that this parameter is not returned for primitives that cannot fail, such as F-DELETE, F-CLOSE, and F-DESELECT. For such primitives, only *action-result* is returned. *See* action-result parameter.

state transition. In DSM, a condition that exists when a process is in transition from one state to another. State transitions for PROCESS objects include ABORTING, STARTING, STOPPING, and SUSPENDING. *Also called* summary-state transition.

status. A Compaq procedure completion code that indicates the outcome of a call. This code can assume one of nine values.

storage group. File attributes that provide information about a file and the data stored in it. These attributes are negotiated at association establishment. The storage-group attributes include the following:

- Storage account
- Date and time of creation
- Date and time of last modification
- Date and time of last read access
- Date and time of last attribute modification
- Identity of creator
- Identity of last modifier
- Identity of last reader
- Identity of last attribute modifier
- File availability
- File size
- Future file size

string-significance parameter. A parameter of *contents-type*. This parameter applies to the semantics of the file transfer. The values of this parameter are fixed, variable, and not-significant. *See also* maximum-string-length parameter, relaxation, *and* contents-type parameter.

structured query language. *See* SQL.

subdevice. A logical entity maintained by a Compaq subsystem to provide access to a physical connection—that is, to a communications line. There may be one or many subdevices associated with a given line or process. Exactly what constitutes a subdevice differs depending on the subsystem. In OSI subsystems, a subdevice allows communication between a process at a particular OSI layer, such as an FTAM initiator or responder, and the local Compaq OSI server process (TAPS, TSP, or NSP) that provides the services of the next lower layer. Each initiator subdevice handles one association or (at layers below ACSE) one connection. Each responder subdevice handles one attach, which is used to establish an association requested by a remote application.

A Compaq FTAM initiator subdevice is created dynamically when an association is established and usually lasts only as long as the association exists. A Compaq FTAM responder subdevice is created when the responder issues an attach.

subsystem. (1) A term that generally defines the Compaq software or hardware facilities that provide users with access to a set of services and other resources. (2) In the context of DSM, a program or set of processes that manages a cohesive set of

objects. Each subsystem has a process through which applications can request services by issuing commands defined by that subsystem; in some cases, this process is the entire subsystem. Many subsystems also have interactive interfaces.

Subsystem Control Facility. *See* SCF.

Subsystem Control Point. *See* SCP.

Subsystem Programmatic Interface. *See* SPI.

subtree. A part of a tree comprising an arbitrary node as the subtree root node and all the other nodes that can be reached by a path from this subtree root node. *See* tree.

summary state. A DSM state. *See* state (definition 2).

summary-state transition. *See* state transition.

super group. The set of Compaq NonStop Kernel users whose group ID is 255. User IDs within the super group confer implicit authorizations not available to other users, including the ability to execute sensitive SCF commands.

super ID. The Guardian user ID represented by the pair of numbers (255,255). The local super ID is the group manager for the super group. By default, the super ID can execute any command without restriction.

supported file attribute. A virtual filestore (VFS) file attribute that can be referenced or modified. *Contrast with* partially supported file attribute.

swap disk. *See* swap volume.

swap volume. An optional disk volume used as an additional memory source during the operation of any process under the Compaq NonStop Kernel.

TACL (Tandem Advanced Command Language). The standard command interpreter and tool set for the Compaq NonStop Kernel.

tag parameter. An optional procedure-call parameter you can use in nowait applications on Compaq NonStop systems to match nowait I/O requests with completions. If there are multiple I/O requests outstanding in your application, the *tag* indicates which one has completed.

TAL (Transaction Application Language). A high-level, block-structured language used to write systems software and routines that support transaction-oriented applications on Compaq NonStop systems. The TAL compiler translates source programs written in TAL into executable object programs.

Tandem Advanced Command Language. *See* TACL.

Tandem application, presentation, and session process. *See* TAPS process.

Tandem LAN Access Method. *See* TLAM.

TAPS (Tandem application, presentation, and session) process. A process in the OSI/AS subsystem that performs service and protocol functions for ACSE (in the Application Layer), the Presentation Layer, and the Session Layer. The TAPS process

also performs some management services in the DSM environment. *See also* NSP process *and* TSP process.

TAPS subdevice. A subdevice, maintained by OSI/AS, that enables communication between an FTAM initiator or responder and the TAPS process. *See* subdevice.

TeletexString. The character-string type of strings conforming to CCITT Recommendation T.61. These strings do not contain format effectors.

TLAM (Tandem LAN access method). A Compaq product that implements, for LANs, the services of the Data Link Layer and layers below.

TPDU (transport protocol data unit). *See* PDU.

trace file. The file in which the SCF trace facility collects trace information while a trace is in progress.

Transaction Application Language. *See* TAL.

transfer syntax. In the Presentation Layer, the definition of the exact bit patterns to be used to convey specified kinds of information in a communication. *See also* abstract syntax.

transient error. An ISO-defined type of diagnostic error that may not recur if the sequence is repeated but does indicate the failure of the operation being performed. *See also* error type, informative message, *and* permanent error.

transition state. *See* state transition.

transport address. *See* TSAP.

Transport Layer. Layer 4 in the OSI Reference Model. This layer provides reliable data transfer.

transport selector. *See* TSEL.

transport service access point. *See* TSAP.

transport service provider. *See* TSP.

traversal. An ordering of the nodes in a tree such that each node occurs only once, and which is determined by an algorithm applicable to all possible trees.

tree. A connected hierarchical file structure in which each node is linked to other nodes by directed arcs in such a way that one node has no inbound arcs, and all other nodes have exactly one inbound arc. *See also* subtree.

TSAP (transport service access point). A network-unique address in the Transport Layer through which connections are established and maintained. *Also called* transport address.

TSEL (transport selector). A logical address in the Transport Layer through which transport services are made available.

TSP (transport service provider) process. A process in the Compaq OSI end system that performs service and protocol functions for the Transport Layer and for the internet

protocol (IP) of the Network Layer. TSP processes are provided by the underlying OSI/TS subsystem. *See also* NSP process *and* TAPS process.

UA (unstructured all data units). An access context for which data is transferred as file-contents data elements; that is, only the data contents of the file are transferred. *See* access context; *contrast with* FA.

unconfirmed service. A subsystem service in which the initiating application sends a request to a responding application without a response being returned to the initiating application. *Contrast with* confirmed service.

unconstrained class. An ISO FTAM service class consisting of the kernel functional unit and (optionally) any other functional unit.

universal-class number. (1) The ASN.1-specified tag for the character-string type used on a data transfer. (2) A parameter of *contents-type* that specifies a code for this tag. *See also* relaxation *and* contents-type parameter.

unstructured file. The structure of FTAM-1 and FTAM-3 files, in which the complete file is treated as one FADU.

user abort. An association abort initiated by the application. An abort leaves the status of any interrupted operations undefined. FTAM provides the F-U-ABORT service to allow applications to request a user abort. *Contrast with* provider abort.

VFS (virtual filestore). A virtual interface for FTAM requests to a file storage system. The Compaq FTAM responder implements a VFS that translates requests into Guardian file-system operations. Files accessible via the Guardian file system can also be accessed via the VFS component of the Compaq FTAM responder. This includes all files on the Expand network to which the responder process' system belongs. The Compaq FTAM responder uses the VFS to access the Guardian file system in servicing requests from a remote FTAM initiator.

VFS profile. A Compaq FTAM profile used as a template to configure multiple responder processes. *See also* FTC profile.

VideotexString. The character-string type of strings conforming to CCITT Recommendation T.100. These strings contain format effectors.

ViewPoint operations console application. An extensible interactive application for operators of Compaq NonStop systems. The ViewPoint application allows a system or network to be controlled from a single terminal. It includes several block-mode display screens for event messages, a block-mode display for system or network status, a conversational TACL screen, and a facility called Define Process to maintain sessions with multiple subsystems at the same time.

virtual filestore. *See* VFS.

VisibleString. The character-string type of strings containing any of the 94 graphic characters and the space character, as defined in ISO 646. These strings do not contain format effectors. *Also called* ISO646String.

wait mode. In Guardian file-system operations and some APS operations, the mode in which the called procedure waits for the completion of an I/O operation and then returns a condition code to the caller. *Contrast with* nowait mode.

warning. An information-only message returned by the system, indicating a possible problem. A warning can be significant, but does not cause the command or operation to fail. A warning is less serious than an error. *Contrast with* error.

write functional unit. A functional unit that allows the following activities on an association:

- Establishing the file-open regime
- Transferring data from the initiator to the responder
- Releasing the file-open regime

X25AM (X.25 Access Method). A Compaq product that implements the services of the Network Layer and the Physical Layer for WANs.

X.25 network. Any network or subnetwork linked using X.25 standards. X.25 standards are CCITT standards that define packet-switching carrier communication in the Network Layer over wide area networks (WANs).

$*process-name.* A variable that represents the Guardian process name of a Compaq initiator or responder process. An SCF command that uses this form of process name is sent directly to the specified initiator or responder process, rather than to the APLMGR process. *Contrast with* indirect-process-name.

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